MUNICIPAL ENGINEERING

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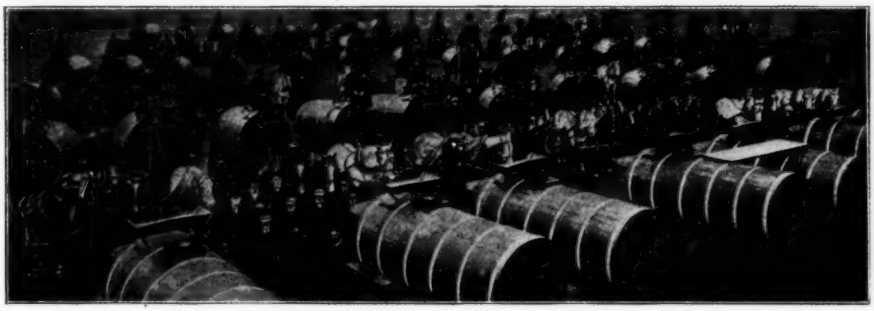

THE ST. LOUIS BATTERY OF STREET SWEEPERS AND SPRINKLERS.

VOL. XLVI. FEBRUARY, 1914. NO. 2.

Municipal interest is interest in the conduct of the business of the city. Communal interest is interest in the welfare of the city and its inhabitants. Good conduct of city business is a matter of course in a German city and he spends his energy in making his city attractive, especially to the wage-earner, who is the important factor in communal development. American cities need to pay attention to municipal interest and should not allow the demand for the "city beautiful" to over-shadow the demand for the well governed city, administered to give the greatest good to the greatest number.

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PAVEMENTS OF TRENTON, N. J.

By Harry F. Harris, Assistant Engineer of Streets.

In this article Mr. Harris makes some important points. One is the awakening of a staid and conservative small city to the necessity of good paving; another is the effect of the quality of the service obtained under the city's commission form of government upon the character of the streets and their economy; his history of the development of the present system is not uncommon, but it is clearly stated so that the city not yet embarked upon the paving voyage can readily learn from Trenton's experience and escape its mistakes.

TRENTON, New Jersey, has been a laggard in improvements to its streets, as in other municipal enterprises, but of recent years the city has taken a new lease on life. Much of this awakening the writer firmly believes can be attributed to the stimulus created by the adoption of the Commission form of government.

In reviewing the paving history of Trenton it can be treated as a series of epochs.

The early streets were paved with cobble stone, first laid in 1866, according to records of the City Clerk. During the next five or six years a considerable amount was laid.

In 1871 an experimental Nicholson wood block pavement was laid, but it was not a grand success, and a few years later the street was repaved with Belgian block. This street was North Broad, from State to Hanover, and the blocks were procured at a local saw mill.

From about the time the wood block pavement was replaced until 1885 was the era of Belgian block paving, during which many of the principal thorofares were first improved.

During the succeeding period a considerable number of streets were improved with asphaltum (coal tar) block.

The next evolution in paving history took place in 1892, with the introduction of modern pavements. During that year the first vitrified brick pavement was constructed, under the supervision of the present Director of the Department of Streets and Public Improvements, Mr. J. R. Fell, who at that time was City Engineer. This pavement is in use to-day and is in comparatively very good shape after having been in use for twenty-one years, and is good for at least five more years of wear. The pavement was constructed with a brick which was manufactured in East Palestine, Ohio, and was known as the "State Line" brick. The bricks were laid on a concrete base 6 inches in thickness and were grouted with portland cement filler, and the pavement cost complete, including excavation, $2.30 per square yard. No provision was made for expansion either transversely or longitudinally. Immediately after the first brick pavement was constructed a local firm, Oliphant and Pope, began the manufacture of brick for paving purposes, and they succeeded in making a very good grade of brick. A number of pavements laid with such brick are in use to-day and are generally in good condition, altho some have been replaced during the last few years. Brick continued to be laid in considerable quantities until about 1900, when the craze for noiseless pavements began.

A few streets were paved as early as 1896 with sheet asphalt and at spasmodic intervals thereafter. In 1900 the city officials began to repave the principal business streets of the city with this mate-

rial, using in a great many instances the old Belgian block as a foundation after they had been relaid and the joints filled with sand. This worked quite successfully in a number of instances, but in others it would have been more economical to sell the block and construct a new concrete foundation, probably at no greater cost, and thereby obtain a foundation of greater strength and durability as well as increase the life of the pavement. Lake asphalts were used exclusively until 1907 for constructing the asphalt pavements, with the exception of two streets which were laid with Green River Kentucky rock asphalt, but these showed signs of failure immediately after being laid, and were subsequently repaved with Trinidad Lake asphalt.

¶ IT PAYS *to use good material, even if the first cost is greater.*

Here an interesting point in the story is reached. It is a well-known fact that in the early stages of the asphalt industry the business was pretty nearly all monopolized by one or at the most two large corporations in each city. This was particularly true in this city. Another firm began bidding for work with a material which was claimed to be "just-as-good" and considerably cheaper. The material was a residual asphalt from California, but unfortunately for the asphalt the firm bidding had no previous experience in laying sheet asphalt. They bid quite low and were awarded a number of contracts. In order to compete with these inferior asphalts the original bidder began "skinning" the work and was detected by his competitor, who at once demanded an investigation. The investigation sustained the charge that the wearing surface was not of the required thickness. The two firms were doing work on adjoining sections of the same street. The investigation revealed the fact that in many instances the wearing surface was but 1¼ inches and in some places but 1 inch in thickness instead of 2 inches, as called for by the specifications, and in one case a thickness of but ⅞ inch was found. After tapping this pavement, which was laid with Trinidad asphalt, an examination was also made of the pavement adjoining. This was found to be of the required thickness and in numerous places slightly in excess. Both of these pavements were laid on concrete base 4 inches in thickness. Price complete, including excavation, was $1.67 for the residual asphalt and $1.55 for the lake asphalt, under a five-year guarantee. These prices were below actual cost. But the remarkable part of the tale is this: The pavement laid full thickness shortly after being laid began to show signs of disintegration and wear until at the expiration of the five-year guarantee period the pavement looked like a crazy quilt and had cost a considerable amount each year for maintenance, while the pavement which had been "skinned" has not shown any signs of wear whatever after seven or eight years of traffic and is apparently in as good condition as the first day it was laid, thus showing the superiority of the high-grade asphalt, even tho handicapped by the deficient depth of material.

¶ GOOD PAVEMENT, *laid with good materials, tho not of specified depth, proved the most durable.*

Just prior to levying the assessment for the portion of the street laid with material of insufficient depth, the residents made it known that they would refuse to pay full assessment on the grounds that they were not benefitted to the extent of a pavement constructed of full depth. The city agreed in this contention and sued the company to recover the amount which it would have cost to construct the pavement full depth. The city retained an eminent consulting engineer to assist in preparing the case for the city's counsel and he at that time, after making a thoro analysis and examination, reported that, while the street was not constructed of the required depth, it would, in his opinion, more than outlast the guarantee and that it was constructed in an excellent manner (except for the depth) and with high-grade materials and with an asphalt of exceptional quality. Time has proven that his contentions were entirely correct.

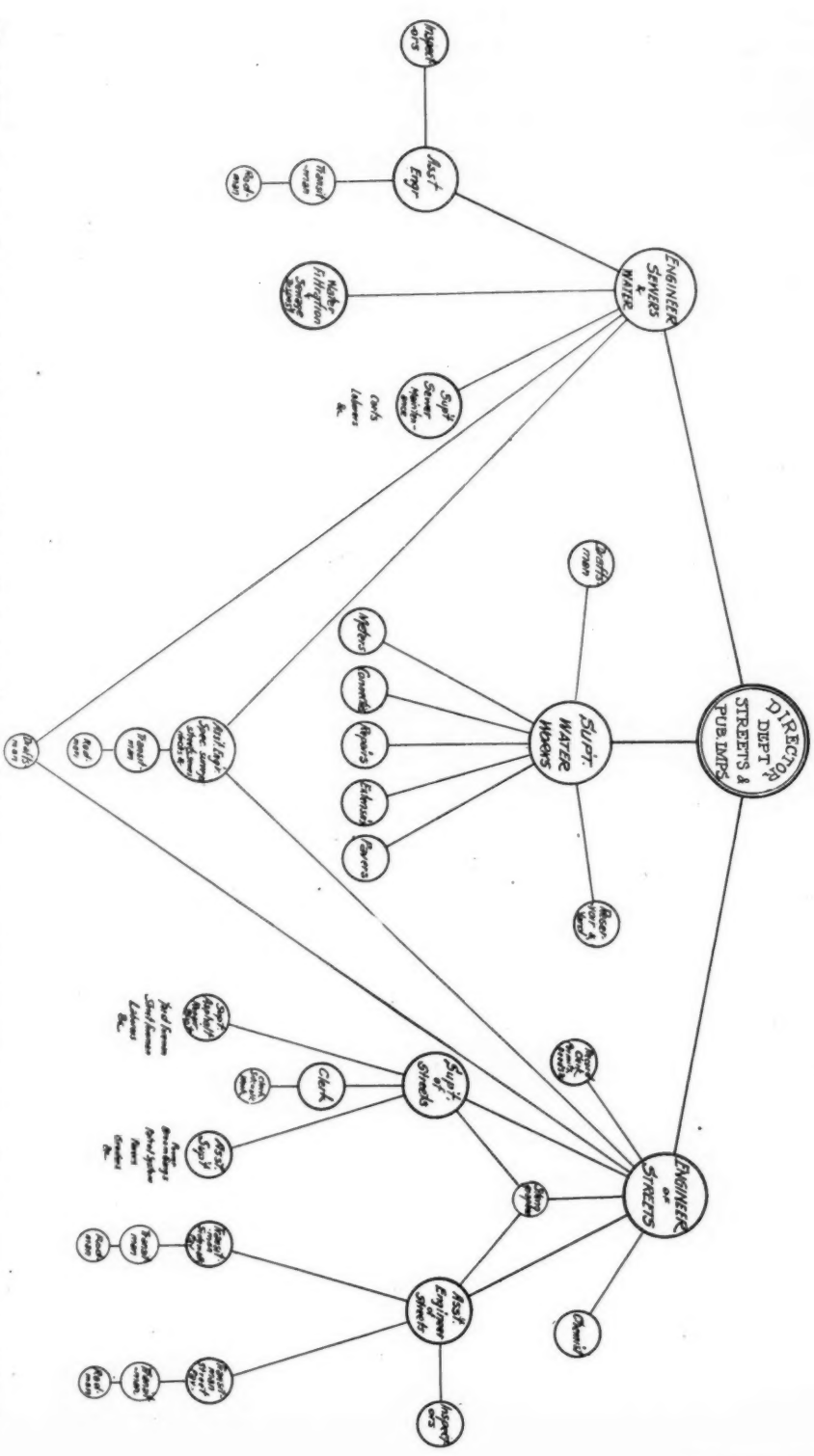


CHART *showing the organization of the Trenton, N. J., department of streets and public improvements. Note the method of showing the interpendence of officers and the division of labor of some employes between two or more such officers.*

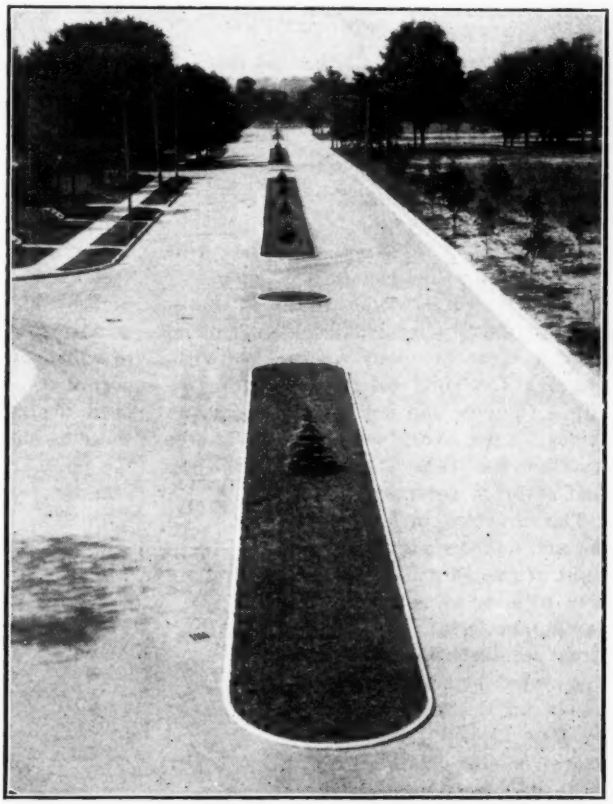
This experience with the two classes of asphalts has had a tendency to somewhat prejudice the city officials in favor of the Lake asphalts, altho we have one very large pavement constructed with "Texaco," which has been down for a period of about three years and is giving excellent satisfaction, as well as one or two with other brands of "California." For this reason the largest percentage of the number of miles of asphalt streets is constructed with Bermudez and Trinidad asphalts.

The next epoch marks a departure in the type of asphalt pavements to bituminous or asphaltic concrete pavements. It is an epoch also by reason of the fact that the city first began to lay pavements of a proprietary nature. The first of these was constructed in 1908, composed of a ¾-inch stone and sand which was bound together with a so-called "waterproof paving cement." Several miles of these pavements were laid in various types, none of which have given entire satisfaction. After three years' use considerable repairs have had to be made under the 5-year guarantees. They were laid upon streets carrying moderately heavy traffic. The city at that time did not employ a chemist and therefore very little supervision was exercised over the quality and kind of ingredients used in the paving mixtures. The cheaper pavements cost, including excavation, a 4-inch concrete base (1:3:6) and 2 inches of wearing surface and a 5-year guarantee, $1.50 to $1.58 per square yard, and the most expensive type cost $2.48 constructed under the same conditions.

In 1911 the city adopted the Commission form of government and fortunately, the people elected a civil engineer as one of the commissioners, who was afterwards selected as director of the department of streets and public improvements. He immediately began to make a detailed inquiry into the workings of the department. After considerable thought and study the department was reorganized in accordance with the chart herewith appended. After this, steps were taken to establish some new policies and departures in the administration of the department. Among the reforms instituted were the following:

The standard specifications were adopted for use in the city, thus insuring open and free competition on all future work.

City paving inspectors were placed on a merit basis and an effort was made to start an educational campaign among them to increase their efficiency.



NEW STREETS *are often designed with parking in the center. This is a view of Parkside avenue, on which filbertine pavement was used.*

Neither patented nor macadam pavements are recommended for any future improvements.

Estimates are made up and bids received in bulk under the alternate bidding plan for the entire year's work with the idea of bringing about the maximum amount of competition, thereby reducing the cost to a minimum.

Employment of a city chemist, to supervise especially the asphalt work.

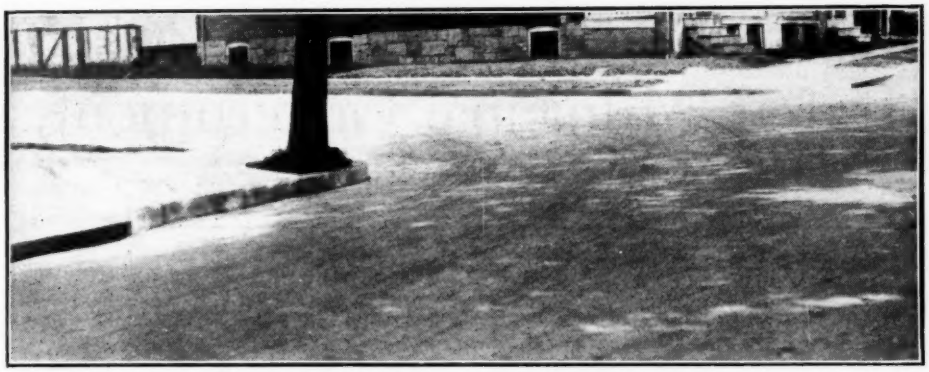
The city returned again to the extensive construction of vitrified brick pavements after a lapse of many years. Notwithstanding the good results heretofore obtained the city had not used brick to any extent for ten years. A brick rattler was installed, and tests are made on each car load of brick received.

The practice of accepting and acknowledging the right of the abutting property owners to select the paving material on each street was rejected. Selection was placed in the hands of the engineering department, subject to approval of city commission, altho due consideration is given to the preferences of the owners.

During the coming season grouted granite block pavements and wood block will be given serious consideration. Two very small sections of wood block, amounting to perhaps 400 yards in all, were laid several years ago under very unfavorable conditions. One was laid on a grade of about 3¾ per cent. and the other on a street where car tracks existed and the transverse grade was found to be 6 per cent. Both of the pavements were of course failures and the blocks have been replaced with other material. During the last two years the city has experimented with concrete pavements to a small extent, using both the one-course and two-course pavements. These pavements have been used on alleys exclusively with varying degrees of success.

Special attention has recently been given to the details in the design of streets. For instance the department has endeavored to combine utility and beauty. Parking of streets, where they are wide enough and the locality suitable, is now a regular policy. Every effort has also been made to eliminate the unsightly and undesirable valley or dish gutters. Where storm water drains do not exist to which to connect inlets and the grades permit it, reinforced concrete trunks have been designed and constructed. One of these is shown in one of the accompanying photographs. Likewise, in several instances reinforced concrete inlets have

REINFORCED CONCRETE INLET *to sewer, showing its adaptability to concrete gutter on curve and without breaking the continuity of the concrete curbing.*



BETWEEN *the inlet in the curb at the extreme right and the outlet at the extreme left runs a reinforced concrete trunk to carry the storm water on the main street across the side street without using the dish gutter, there being no storm water sewers in this district.*

been designed and used in localities where it has been found necessary to place a great number of inlets to intercept surface water. These have been substituted where the use of so many iron inlet frames would have a tendency to disfigure and mar the curbing and general effect. It was found that this type of inlet was readily adaptable to all kinds of curves, without affecting their continuity.

These innovations and departures in administration and public policy, the writer believes, mean much for the taxpayer, not only in increased efficiency but ultimately in vast savings in dollars and cents, for the present system represents a more progressive and business-like method.

The total mileage of all streets and alleys has been computed to be 146.67 miles, of which 46.84 miles are paved. This shows that 32 per cent. of the total mileage is paved, made up as follows:

	Miles.
Asphalt	18.36
Brick	10.82
Belgian Block	4.79
Bituminous Concrete	8.78
Concrete	0.90
Macadam (water bond)	3.19

These figures do not include the pavements laid in 1913, nor the several state roads taken over by act of Legislature.

GOOD MONEY IN SWIMMING POOL

The cost of building and operating the St. Louis public swimming pool has been stated as follows by Park Commissioner Davis, who has it in charge. He shows that during the two months the pool was in use last summer 500,000 people used it at an actual per capita cost of 1½ cents each. Interest on the money used in building the pool and depreciation of the property brought the per capita cost to 2½ cents for each bather.

The cost of building and operating the pool is itemized:

For grading and ground shaping, $13,000; for concrete paving, $9,000; sand beach, $1,000; dressing rooms, $16,000; ornamental lighting, $1,860.64; fencing, $925; miscellaneous, $1,200. Total cost, $42,985.64.

The pool was used for two months at this maintenance cost:

Salaries, $5,609; laundry, $500; janitors' supplies, $75; towels, $671; bathing suits, $1,945; electricity, $84.55; water, $1,920; miscellaneous, $1,200; interest and depreciation on the property, $4,444.90. Total, $16,148.85.

Representative Against Concentrated Municipal Government.

By James L. Mayson, City Attorney, Atlanta, Ga.

While Mr. Mayson's view may be influenced too much by the notable successes which Atlanta's citizens have had in securing good results from a form of government notably lacking in closeness of organization, he states some truths which it will be well for all to consider along with those in Mr. Bradford's article in the December number of MUNICIPAL ENGINEERING.

"FOR FORMS OF GOVERNMENT LET FOOLS CONTEST,
WHATE'ER IS BEST ADMINISTERED IS BEST."

IT seems to me that the slightest consideration of government, national or local, would lead finally to the conclusion that that government is best which is best administered, without regard to form.

Certainly no form of government can be devised which by some sleight of hand will universally eliminate either real evils or imagined evils. I use the latter terms advisedly. There are frequently more evils imagined, by more or less of the citizens, as existing in the local government, than there are real evils. At any rate, the fact that the commission form of government works well in one city is no reason why it would work well in another. To say this would seem to express the simplest truth. Yet the advocates of the commission form of government present that form as a patent medicine, namely, as a form that will cure all municipal evils. The error is so apparent that any one except an enthusiast would discover it.

It is claimed there are about three hundred municipalities, of varied sizes, which are operated under the commission form. This commission idea appears to have been in existence for about twelve years. Now it is surprising that a form of municipal government which is a universal cure and which will bring to all municipalities relief from all municipal evils, has only been accepted by three hundred cities during twelve years of effort. It is, furthermore, surprising that this limited result has come to pass when this idea has captured the ear of the municipal and daily press. It has been dinned into the ears of dissatisfied citizens for this long time, and the result has been so exceedingly small as to be startling when we consider that the American citizen is so quick to realize the use of improvements. For instance, a patent which has in itself much good is readily taken up by corporations within much less time than twelve years. So this patent-medicine scheme for curing municipal troubles would certainly have been more generally accepted within twelve years if it had in it the virtue claimed by its progenitors.

Again, it is amusing to see that the advocates of a commission form of government do not agree upon the essentials thereof. Surely a discovery of this importance would have some central truth about which all minor differences would gather and crystallize. Yet we find as many varieties of the commission form of government as there are modes of medicine, each one contending that it is the

only simon pure article, and all others are frauds and mistakes.

For instance, in one form a board of commissioners, of a limited number, is elected by the people and given supreme power over municipal matters. Of course, the fact that there are only five elected as commissioners, instead of a board of aldermen of twenty or thirty, makes all the difference in the world. Where the people elect a small number of men there is no politics in it at all. Where they elect twenty or thirty there is a great deal of politics. At least this is what the gentlemen who are exploiting this municipal doctrine tell us.

¶ THE COMMISSION APPOINTED *by the Governor and the single headed commission are both undemocratic.*

Again, the governor sometimes appoints six or seven commissioners. Now, we all know that politics is a thing foreign to any governor of any state. He would never, for anything in the world, appoint his friends commissioners as a reward for faithful services. We know that this is never done, beginning with the greatest states, like New York and Pennsylvania, and coming down to the smallest. The fact that the governor does the appointing hedges the thing around with a divinity which should bar all criticisms. At least this is what the advocates of this particular form claim.

But the third and last form of the so-called commission government served out to the American citizens is that form which selects one man to run the town. This is so foreign to a republican form of government, local as well as national, that it is difficult to see how any man could seriously insist that this method be adopted. Look over the citizens of your own town, whether it be a big or little one. Put your finger on any one man to whom you would be willing to give all power in your particular municipality. If there be such a man, I undertake to say he would never serve in that capacity; he would not accept the responsibility. The fact that he is acceptable is the very fact which makes him decline to accept the position. Therefore we fall back upon the man who will take the job, the politician, the delight of the daily press and cartoonist. We presume the giving of all power to any one man makes this one man a better man than he would be if he was one of twenty or thirty. At least this is the argument back of the suggestion.

So we submit that there are so many forms of commission government, whose advocates cry "lo here!" and "lo there!" that our minds are confused and we are undecided whether to take the allopathic form of the single commissioner or the homeopathic form of a board of commissioners elected by the people. Its advocates and the press, strange to say, are unable to see the ridiculous absurdity presented by these confused forms of government supposed to be remedial of every evil.

We are told that the fact that only a few men are elected to take charge of city matters makes the selection of the few men more important, and, therefore, causes better men to be elected. But this is untrue, as shown by the fact that where commission government has been established many of the former officials have been elected commissioners. In other words, the change of the form of government has not changed, in a majority of instances, the men who control.

¶ MANY SPECIAL FEATURES *of modern city government are claimed by the advocates of the commission form which have been in use with other forms for many years.*

Again, the doctrine of recall and referendum is set forth as peculiar to the commission form of government. It does not appear to these advocates that this is unfounded. For instance, the same principle can apply to the aldermanic form of government. In our own city of Atlanta it has recently been incorporated as a part of the charter of the city and it is just as workable in the aldermanic as it is in the commission form of government.

We are told that more careful attention is given to streets, water supply and

other pubilc works under the commission than under the aldermanic form of government. Of course, this is a mere assertion by one friendly to the former as opposed to the latter. The statement could be as easily reversed and just as emphatically made.

In Atlanta we own our water works system, as opposed to Birmingham, a city governed by commission form of government, where the water works system is owned by a private corporation. How is it that the aldermanic form secures for the people its own water works in one city and the commission form does not secure for the people its own water works in another city, if the commission form has the power so extensively to revolutionize local situations and produce results remarkable for progress and general betterment?

¶ RETIREMENT *and prevention of floating debts and revenue from interest on city funds are not special prerogatives of the commission form.*

Special emphasis is put upon the fact that floating debts have been retired in Galveston and other cities. This is mentioned as resulting peculiarly from the form of government adopted. That this does not follow is shown in our own city of Atlanta, where floating debts were abolished as far back as 1874, under a charter which provides for an aldermanic form of government. Since that time floating debts have been unknown in this city. The same thing doubtless exists in many municipalities governed by council or board of aldermen. It is unfair to claim that a simple change of a form of government from the aldermanic to the commission form will pay off floating debts or prevent same from being incurred. A simple examination will show that one or two cities, under the councilmanic form, have done these things. This was caused not by the form, but by the officers. The same thing could happen under the commission form if the same character of officials were elected.

Again, this article says that funds on deposit in banks have been made to yield a revenue. Now, this statement is made for no other purpose than to say that it results from the adoption of the commission form of government. In the city of Atlanta this has been done for many years, so long ago that few people could now tell the particular year in which it was begun. Yet it is here set forth as peculiar to the commission form of government. On the contrary, it has been done, in many instances, by cities under the aldermanic form, and that long before the idea of commission government in cities was ever thought of.

Again, the method of accounting is said to be improved in cities adopting the commission form of government. It seems childish to say that the method of accounting will be good under a commission form and must be bad under an aldermanic form of municipal government. It is opposed to all experience. These things depend upon the character of the officials rather than upon the form of local government. However, if some simple fact is needed which will destroy this impression, I refer to the fact that the most scientific and modern form of accounting ever conceived is that adopted by the United States for municipalities, and that this form has been in use generally in many municipalities and is in use in my own city of Atlanta, where the aldermanic form prevails. A city can have a good system of accounting under one as well as under the other form of government. This is not a statement by a zealous advocate, but an examination of the census reports in Washington will disclose this fact.

¶ VICE AND CRIME *can be and are suppressed as well or better under other forms of municipal government.*

Again, we are told that crime is suppressed better and vice has been restricted more under the commission than under the aldermanic form of municipal government. Let us see. In none of the cities governed by a commission have the houses of ill fame been closed. Yet in Atlanta and other cities where the aldermanic form of government is maintained this has been done. Now, I do not main-

tain that this was done because of aldermanic form of government. I know it was done because of the officials in the city rather than the form of the city government. Yet it is conclusive evidence that vice can be restricted under either form of government when I mention one city where it has been done, which has not a commission form of government, even when I challenge the production of a city under the commission form which has done it.

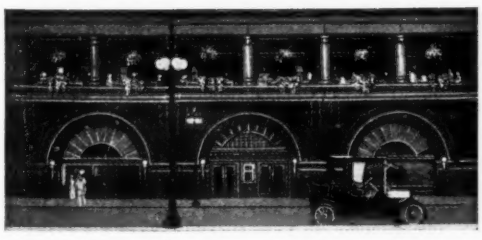
So on down the line. The bold declarations made in favor of the commission government, "glittering generalities," said to attach to this form, leaving the impression that these very desirable things will not arise under an aldermanic form, are all idle vagaries and unsupported by fact.

The present discussion is old. When man began looking around for a form of government this discussion arose. At first the kingly form was deemed best. Yet history shows that all power, national or local, cannot be given to one man. It took the race many years to find this out, but it has found it out, and that fact is now generally accepted. Yet we are now told that one man can best manage a city and that is the particular form of government to be commended. We insist that this is simply returning to a worn-out error and that very few cities will try it long.

After man found out that the "one-manager" idea would not do, he decided that two or three "managers" would be all right. Thus the oligarchy came into existence. It took some governments many years to find out that this was not only a weak form, but a very vicious form. It was rejected many years ago, and has not even been discussed as a desirable form of government until of late years, when this worn-out plan has been held up as the model form for municipalities. History will simply repeat itself. The old idea of board or commission will last for a while, but will become weakened. Concentrated power will bring corruption and the commission form of government will explode just as the old oligarchy passed away and is now buried beneath years of contempt.

In the progress of time it was ascertained that while a republic was not always the strongest form of government, yet in the end it was the most honest form. At last, it is better to have honesty in the individual, as well as honesty in public matters, than it is to have too much shrewdness. Bacon was said to be the "wisest, brightest, but meanest of mankind." No one holds him up as a model. The commission form may be bright, but it is not republican. It is opposed to the march of events. It will pass away in a few years. Coming generations will dig around its ruins and wonder at the credulity of the Americans of the present day who undertook to model their cities around a form of government rejected by their progressive ancestors before America was discovered.

WINDOW BOXES IN A BUSINESS BLOCK



Beautiful effects may be obtained by combinations of foliage plants giving contrast and color. Dracenia, Vinca, English Ivy, Coleus, Boston Fern, Dwarf Canna, Coben Scandieus and many others known to florists may be used. Bay trees or urns at building entrances give beautiful effects. The ingenuity of the citizen will doubtless develop many rare and individual decorations.

Hydro-Electric Development at Stevens Creek, Ga.

By George G. Shedd, Supervising Engineer, Augusta, Ga.

Many of the problems in this structure are the same as those of the municipal water supply engineer. This is from one of the papers provided by the Engineering Section of the American Association for the Advancement of Science, which is now taking high rank among the technical societies.

AT the present time there is perhaps no section of the country that is being so rapidly developed as the South. Contributing in a large measure to this is the development of its water-power resources, and the consequent attractive inducements that are being made to manufacturers to locate here.

A development of 31,000-h.p., ultimate plant capacity, known as "the Stevens Creek Development," is being built for the Georgia-Carolina Power Company, on the Savannah river, about eight miles above Augusta, Ga., to supply the power market centering about that city.

Drainage Area—The drainage area of the Savannah river, including that of Stevens creek, is about 7,200 square miles, at the site of the plant, and is to a large extent rolling country, the upper part being rough and largely covered with forests, while the lower part is cleared and under cultivation.

Run-Off—The lowest daily flow recorded during the period 1892-1912 was 1,610 cu. ft. per second, on October 12, 1904, and the highest 316,000 c. f. s., August 27, 1908. The lowest average monthly discharge during the period from 1884 to 1912 occurred in October, 1904, and was 2,080 c. f. s., and the highest average monthly flow, 46,360 c. f. s., in September, 1888.

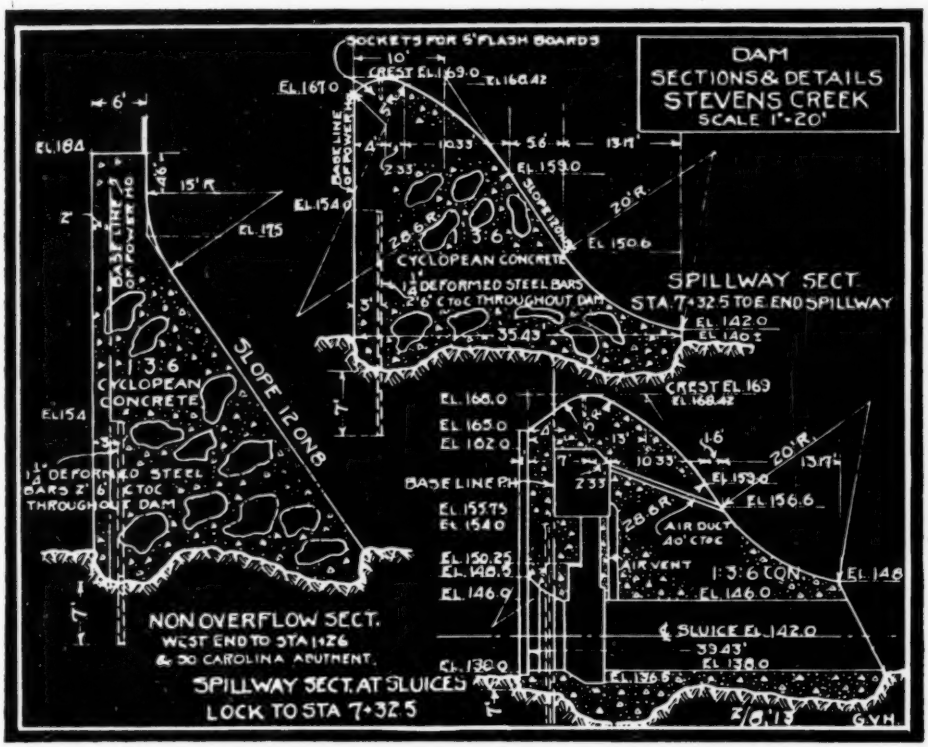
Power Available—The average horsepower available for the development has been computed for a period of twenty-seven years, and on a basis of a load factor of 33 1/3 per cent. is found to be very rarely less than 20,000 delivered horsepower.

Location—The location chosen for this development is just below the confluence of Stevens creek with the Savannah, and practically at the foot of a long series of rips in the main river. This location was determined to be the most economical and safest, after detailed surveys and numerous borings and soundings had been made.

General Description—In brief, the development consists of a dam having a total length, including power house, of 2,700 feet, a power house designed for an ultimate equipment of 31,000-h.p., with a present installation of 15,600-h.p., and the lock 30 feet wide and 150 feet long in the clear. A pond created by the dam extends about 14 miles up the Savannah river and about 13 miles up Stevens creek, and will have a surface area of about 4,200 acres.

Dam—The dam is constructed of cyclopean concrete. The spillway section is 2,000 feet long, of the ogee type, with an average height of about 30 feet and a maximum height of 47 feet. At the average height the sectional area is 619.5 square feet, and the base width 35.43 feet. The non-overflow sections have a combined length of 233 feet, with crest elevation 15 feet higher than the spillway.

The dam was designed to pass safely a freshet of 450,000 c. f. s., which is almost 50 per cent. larger than the greatest freshet on record—that of August 27, 1908, estimated to be 318,000 c. f. s. It is estimated that the 1908 freshet would



THESE CROSS-SECTIONS *of the Stevens Creek Dam show the method of construction. The accompanying photograph shows the spillway with sections in all the various stages of construction.*

cause a depth over the crest of 11.3 feet.

In order to assist in operating flashboards on the dam, as well as to aid in taking care of water during construction, and to provide a means for complying with the government requirement that no water shall be stored when the flow is below a certain specified limit, five sluice gates, 8 by 8 feet each, with Venturi setting, are provided thru the spillway section adjacent to the lock, and are operated at present by hand from a tunnel in the dam, provision being made, however, for a future motor operation.

Provision is made for the future use of flashboards, and sockets are also provided for guard pins, to safeguard the men when operating flashboards. At the request of the U. S. War Department engineers, deformed uplift bars having an equivalent sectional area of 0.625 square inch per lineal foot of dam, are placed vertically 3 feet from the upstream face of dam, extending 7 feet into the ledge and 15 feet or more into the dam, thruout the length of the dam and lock walls.

Great care has been used to secure a good foundation thruout. The ledge is principally an excellent quality of granite and schist, but at three points, one in each of the principal channels, it was necessary to remove from 10 to 20 feet of disintegrated rock before securing a good foundation.

As a preliminary to foundation work, test holes are drilled to determine character of ledge and to locate any possible seams. If necessary to determine extent of seams, Magenta dye has been forced in under pressure. This method has been very satisfactory, in that the character of the ledge being known in advance has prevented unnecessary drilling and excavation, and has also disclosed the presence of several dangerous, smooth, horizontal seams, to which it was necessary to excavate the ledge in order to prevent

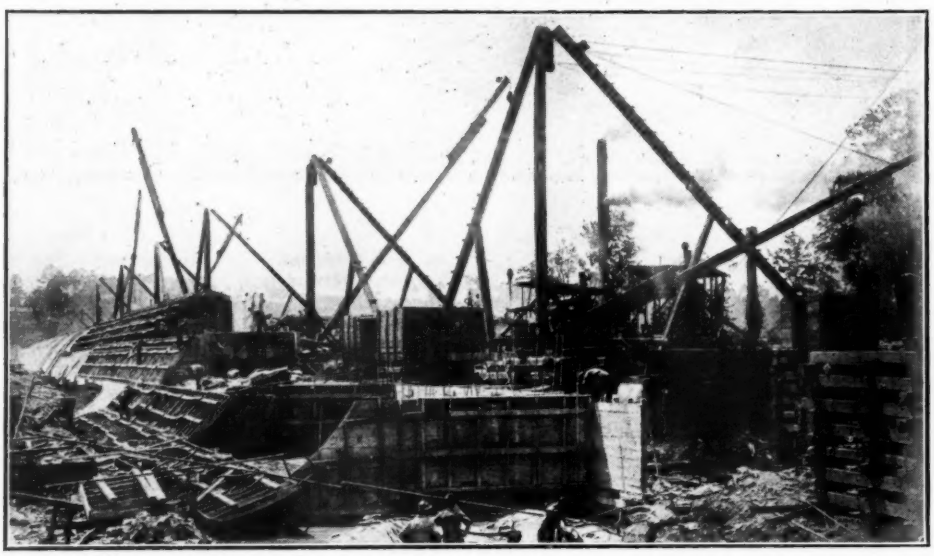
possible uplift and sliding. These test holes, as well as other holes, where necessary, were grouted under 100 pounds air pressure. Whenever necessary to prevent possible sliding, trenches have been cut in the ledge. It is believed that by these methods a very secure foundation has been secured at a minimum cost.

Lock—To meet the requirements of navigation, a concrete masonry lock has been constructed adjacent to the power house. The lock is 30 feet by 150 feet in the clear, and has a lift of 27 feet. There will be at least 6 feet of water over the lower miter sill, and the upper miter sill is 12.5 feet below the masonry crest of the spillway. It will be filled and emptied by means of a 6 by 6 culvert and ports, leading into the side of the lock, and controlled by gates set in gate wells near the lock gates. Heavy wooden lock gates have been provided, to be operated by hand winches.

Power House—The power house is designed for an ultimate installation of ten 3,125-h.p. vertical main units and two 450-h.p. exciters. The substructure is built complete for a superstructure 51 by 388 feet in plan, and consists in its lower part of cyclopean concrete and its upper part of reinforced concrete. The superstructure at present is built for five units and two exciters only, and consists of a steel frame with brick walls, and is provided with a 50-ton electric traveling crane.

Hydraulic Equipment—The turbines are being furnished by the I. P. Morris Company, and are of the vertical, single runner, 75-r.p.m., single-discharge type, 104 inches in diameter, set in a concrete spiral casing, and provided with concrete draft tubes. The efficiency is expected to be better than 86 per cent. Each unit is provided with a double floating lever oil operating governor, which can be controlled from the switchboard or by hand. A central oil pumping pressure system is provided, working normally under an oil pressure of 200 pounds. All operating parts of the turbine are accessible for quick repair, if necessary, making it unnecessary to unwater wheel casing with the one exception of accident to runner. The exciter turbines are 450-h.p., 40-inch diameter, 200 r.p.m., of a type similar to main turbine.

Electrical Equipment—The electrical equipment of the first installation con-



STEVENS CREEK DAM *under construction, as it appeared August* 29, 1913. *A completed portion of the spillway of the dam is seen in the background and the various sections in which the concrete was placed are shown by the work going on in the foreground.*

sists of five Westinghouse, vertical type, revolving field, 3-phase, 60-cycle, 2,300-volt, 2,700-k.v.a. (at 75 per cent. power factor) generators, two 300-k.w., 250-volt vertical-type exciters, three 5,400-k.v.a. transformers, stepping up from 2,300 volts to 44,000 volts. All wiring, where possible, is installed in conduits, buried in the concrete floor.

Transmission Line—The transmission line to Augusta is approximately seven miles long, with Milliken type, galvanized steel towers, designed for two circuits, with three wires on each side. The height to the lowest cross-arm is 50 feet. The tower spacing is approximately ten per mile. At the Lake Olmstead crossing special towers are provided, 80 feet high, for the span of 960 feet. In the city, along the canal, latticed steel poles, spaced 200 feet apart, are used. The wire for the power circuits is No. 1/0 17-strand medium hard drawn copper, and the ground wire is 5/16-inch, 7-strand, copper-clad cable, having 30 per cent. conductivity. A telephone circuit is run on the towers 10 feet below the lowest power wires, and is transposed at every tower, and all instruments are protected by transformers. The power circuits have one complete transposition between the power house and the substation, and are hung on Thomas No. 1118 suspension type insulators.

Substation—The Augusta substation is located adjacent to the steam plant of the Augusta-Aiken Railway and Electric Corporation. On account of the limited ground space, the building was designed with two galleries. There will ultimately be installed three banks of three each, 2,000-k.v.a. single-phase transformers, stepping down from 44,000 volts, 3-phase, to 13,000 volts, 3-phase. Only one bank of three transformers is at present installed. Provision is also made to step down from 13,000 volts to the existing circuits in Augusta of 2,300 volts, 2-phase. All of the switches in the substation are remote control, and will be controlled from the switchboard in the steam station. All apparatus in the substation is furnished by the General Electric Company.

A PERMANENT LIGHTING EXHIBIT

A miniature exhibition of lighting and illumination effects shown by the Illuminating Engineering Society at the International Exposition of Safety and Sanitation in the Grand Central Palace, New York, December 11 to 20, 1913, was awarded a grand prize. In many respects this exhibit was remarkable and unique. Side by side were models and pictures of good and bad lighting. Comparative conditions were clearly exposed. Uses and misuses of light, with their attending good or bad results, were indicated in ways which were at once striking and impressive. So apparent were the advantages and superiority of good lighting that one might have wondered why so many examples of bad illumination could be found. The latter fact is all the more curious when it is learned that good lighting may be had in many cases at a cost not much, if any, greater than that paid for the bad illumination—in not a few instances it could be obtained for even less. It seemed evident that lighting may be good, bad, or otherwise, depending largely upon the care and skill with which it is planned and how it is used. The exhibit consisted of a series of booths and a large collection of pictures.

The entire exhibit, which was installed under the direction of a special committee of the society, is to be placed in the American Museum of Safety, 29 West Thirty-ninth street, New York, where it may be seen free by the public.

This is a demonstration of what a business administration of a municipal electric light plant can accomplish under the management of a competent engineer, J. R. Thomas, the superintendent. The weak spot is found in the necessity of asking the question, "What will the new city administration do to the present organization?"

A BUSINESS-LIKE CITY LIGHTING PLANT

THE success in the operation of the Crawfordsville municipal lighting plant, the history and construction of which was outlined in an article in MUNICIPAL ENGINEERING for February, 1913, vol. xliv, p. 81, has been continued under the same efficient management, the results of whose efforts were given in connection with that article.

The development in the use of electric power from the plant has been phenomenal, especially during the year 1913. This development is shown graphically in the accompanying chart, which shows the proportionate consumption of electricity by customers for power purposes for each month in 1912 and 1913. This diagram shows an almost constant increase, which was especially notable during the last five months of 1913. At the beginning of 1912 the power load on the plant was less than 150 h. p., whereas at present nearly 1,200 h. p. of motors are connected, showing an increase in the two years of at least 1,000 horse power, or more than 650 per cent. There has been a material increase in the lighting load, but it has nothing so remarkable about it as this increase in power load.

Three factors are important in producing this growth.

The first is the ability to produce the power, which was so fully supplied by the efficient management by the construction of the new plant which is described in the article referred to.

The second factor in the growth is the rates for power. These were fixed in September, 1911, at the following low schedule:

First 100 k.w.	4	cents
Next 400 k.w.	3½	cents
Next 500 k.w.	3	cents
Next 1,000 k.w.	2½	cents
Next 5,000 k.w.	2	cents
Next 5,000 k.w.	1¾	cents
Next 10,000 k.w.	1½	cents
Next 10,000 k.w.	1	cent

Up to the beginning of 1912 these rates did not have any very pronounced effect upon the increase in consumption and

the large increase did not begin for a year after the schedule of rates was adopted.

The third factor in the increase in business has been an aggressive campaign for new business, especially in the power line. Solicitation and advertising have both had their effect, and the excellence of the service has retained the old customers and attracted new ones.

DIAGRAM *showing proportionate increase in electricity supplied for power to customers of the Crawfordsville municipal electric light plant. Less than* 150-*h.p. connected in January,* 1912; *nearly* 1,200-*h.p. in December,* 1913.

¶ NEWSPAPER ADVERTISING *proclaims the benefits of the use of electric current.*

Three-column advertisements have been run in the daily papers at intervals which are striking in their showings and in the arguments in favor of the use of electricity for power.

One advertisement compares the 1,000 horsepower of the electric motors in use with the 800 horsepower or less of all other forms of power in use in the city, and rests its argument on the question as to what is the reason for the phenomenal increase in the use of electric power and the answer "Ask any of our power customers."

Another advertisement on the same line shows that 18 of their 56 power customers have exchanged the use of 603 horsepower of other sorts for electricity from the municipal plant, 14 of whom were satisfied with their old plants until the management of the electric plant demonstrated that it could furnish cheapeer and better power.

The latest advertisement occupies four columns, shows the diagram reproduced herewith on a large scale, and contains the following reading matter:

Crawfordsville Electric Light and Power Co.

December was the biggest month in the history of The Crawfordsville Electric Light and Power Co.

Every month shows a material growth in the amount of electric power sold to Crawfordsville factories.

We are not only replacing other kinds of power with electric drive but are furnishing electric power to operate the additional machinery and equipment which the various factories are installing.

Every power user is a booster. Why?

Because electrical power is cheaper. Because electrical power is more reliable. [Our power has been off only 3 minutes in over 2 years.] Because electrical power is more convenient. Because elec-

trical power is more adaptable to any machinery. Because electrical power is available 24 hours in the day. Because electrical power requires no engineer. Because electrical power requires no fireman. Because electrical power requires no boiler insurance. Because electrical power requires no fuel. Because the other savings are too numerous to mention here.

Who purchases the supplies for your power plant, the fuel, boiler compound, packing, belt dressing, oil, waste, gage, glasses, oil cans, belt lacing, odds and ends—You?

Who receives the salesmen and listens to their voluminous arguments—You?

Who listens to complaints about this oil and that boiler compound—You?

Who listens to excuses for lack of power and shutdowns—You?

What is your time worth? Add that to all your power plant bills and contrast the total with the cost of your central station power—power that requires none of your time—that comes to you ready to use—that is always ready—always sufficient.

Those who have made the change are well pleased. Let us convince you.

The test of the permanency of efficiency in municipal operation is about to be made. A change in the political administration of the city took place on January 5 and the question has arisen as to whether the present efficient board and superintendent will be retained, and if they are not, whether an equally efficient management will be selected.

At this point it is pertinent to inquire why a change in the management of a business branch of the city administration should be made simply because a set of city officials has been elected who happen to vote for a different candidate for President of the United States.

The trustees of the Crawfordsville Electric Light and Power Company, owned by the city, who have been responsible for this enviable record, are M. W. Bruner, an attorney; G. B. Luckett, manager of a local brick manufacturing company, and G. F. Huggans, a retired engineering contractor. The executive officer of the board, who is responsible for all the technical matters and the details of operation, is J. R. Thomas, a young man, graduate of Purdue University, who has been in charge of the plant since 1903.

Motorcycles in Contracting Work

"The motorcycle enables a contractor to readily and comfortably supervise different gangs working in different sections at a small expense," states J. Ed Neolp, contractor, Columbus, Ohio. "I purchased my first motorcycle for this purpose in 1911 and so used it for two years at an up-keep expense of but $5.00."

A STREET RAILWAY TRAFFIC SURVEY

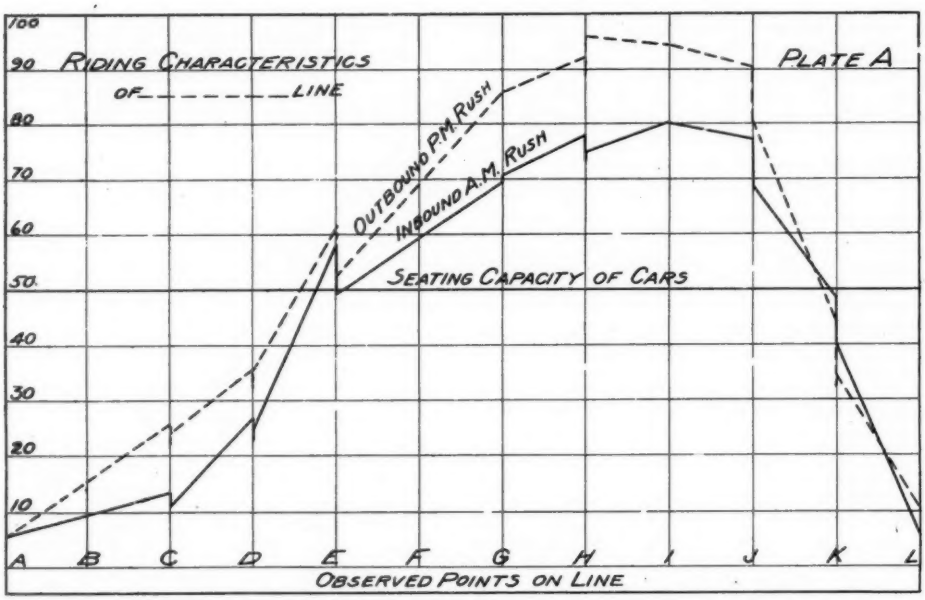
By C. M. Larson, Chief Engineer of the Railroad Commisson of Wisconsin, Madison, Wis.

One of the constant sources of complaints to municipal authorities is the lack of adequate street car accommodations. The author shows in this extract from a paper before the Wisconsin Electrical Association the method of making a traffic survey to show existing conditions, and the method of using the results in making a schedule for running cars.

THE modern street railway manager has at his disposal the means of obtaining exact data relating to traffic conditions and service requirements for every part of each line under his control. If he so desires, these may be plotted into charts that will show at a glance to any intelligent person just how one particular community fares compared with any other. These charts show him just where the operating department is wasting the company's money and why certain lines are operated at a loss when people are constantly demanding better service. By reference to them he discovers that his patrons are not so unreasonable as he had supposed. True he finds from his operating report that he has operated 2,000 car miles per day over this line, that considering the revenue and expense of operation there is no profit in operating this line, but upon a closer inspection of the chart he finds that a very large percentage of the cars have been running at a time of the day when nobody needs them or cares particularly whether they are operating or not. Simultaneously he discovers that during a correspondingly long period of the day, a great many more persons were desiring to ride than he has been providing for. He observes that a uniform schedule has been operated all day with additional cars during the rush periods, while as a matter of fact more than twice as many people ride in the afternoon as in the forenoon. He also discovers that a very small proportion of his patrons live within a mile or two of the end of the line while his cars have all invariably gone entirely to the end to make the turn, with a consequent large number of car miles operated to little useful purpose. His charts also show him that often there are relatively long periods when no service whatever is supplied, when interruptions have occurred. He may have been informed of this by the operating department but its real significance is only shown when plotted in this form.

If the system is of considerable size a traffic study department should be established either under the direction of the manager or the operating officer. If the system is small this officer may himself have direct charge of the details of the work provided he is thoroly familiar with the nature and scope of the investigation to be made. This department should not be a spasmodic affair, dependent for its existence upon a shortage of work in some other department. It should be permanent and should be prepared to supply to the manager or operating department reliable information of traffic conditions for any season, day, or hour, and upon any point of every line.

There is of course more than one way in which data of this kind may be collected, and the method best adapted will readily suggest itself to each company, but in whatever way this is done its collection should be under the direction of



CURVE *showing the variations in traffis at twelve different points on a street car line during the periods of heaviest travel in the morning and in the evening, indicating the points of maximum load and those where part of the service can be terminated. Note where the seating capacity is insufficient.*

the head of the traffic study department in order that results may be consistent and trustworthy. Checks of accuracy should often be made and the men taking the data should receive thoro instructions in methods best calculated to insure accurate results. It is usually desirable to record all data in bound pocket field books, tho printed cards may be substituted if desired.

It is common knowledge that ordinarily there is a certain point on each line near the beginning of the dischargal area where the number of passengers on the cars is usually a maximum. This point is approximately the same for travel in both directions and should be determined quite accurately as this is the point at which future observations will be made which will determine the number of cars necessary for operation of the line both during the rush and the non-rush periods.

Other critical and important points along the line are those where the number of passengers is so small as to justify the termination of part of the service at these points. In collecting these data a count of all passengers on all or a large proportion of the cars on the line should be made at predetermined points at intervals of a few blocks. A count at every block would be preferable in some respects, but this would require the presence of a man in addition to the conductor, while if the count is made only at intervals of several blocks, the conductor can usually do this in addition to his other duties except perhaps on heavy lines or during the busiest periods of the day. The count should cover a long enough period to obtain normal results with 24 hours as the minimum.

The figures thus obtained can be tabulated or plotted as shown on plate "A" attached. This plate shows the typical curve for the heaviest period in the morning and the same for the evening. On this plate is drawn a horizontal line showing the average seating capacity of the cars, and it will be noted that with a complete set of such charts, it is a simple matter to determine the point of maximum load and the points at which part of the service might be terminated. This latter determination cannot of course be made upon a study of the chart alone. A general knowledge of the rid-

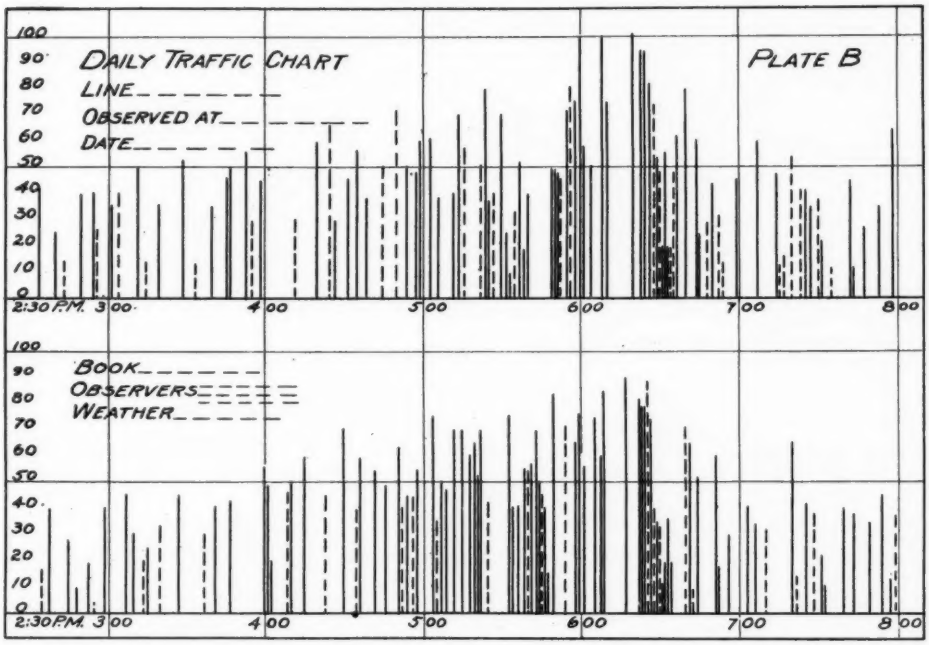


PLATE *showing traffic at different moments during each of two afternoons. Each vertical line shows the number of passengers in the car passing the point of observation at the time shown at the bottom of the line.*

ing habits of the residents in the neighborhood together with a careful study of transfer points must be coupled with the predetermined standards of service before such a point is finally established.

By use of the data thus collected, it is also possible to obtain a fairly accurate estimate of the average distance passengers are hauled for a single fare.

Having determined the point on the line where traffic is heaviest, accurate counts should be made covering a period of several days to insure normal results. For this purpose it is desirable to station checkers at the point in question with instructions to collect the following information for each car in both directions; the data for each direction being kept separately, preferably on opposite pages of a note book:

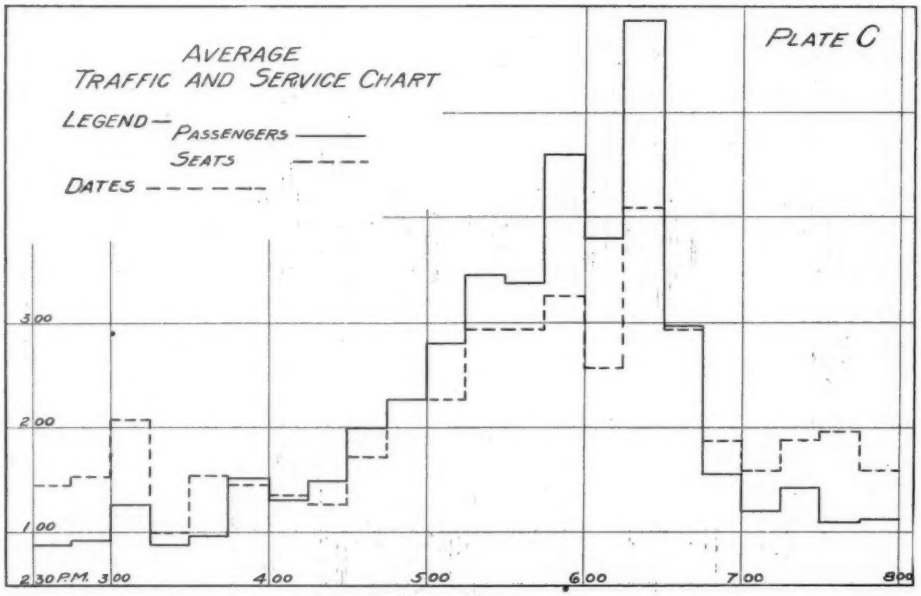
a. Route on which the car is operating.
b. Destination.
c. Origin when possible.
d. Run number when possible.
e. Car number.
f. Arriving or leaving time.
g. Total number of passengers.
h. Such other information as is desirable.

The field book should be ruled in columns with proper headings and in cases the cars come too often to permit of collecting all the data, only such as are positively necessary should be required. But in no case should a car be permitted to pass without a note to that effect even tho no data are taken.

It has been found that if the checker is familiar with the seating capacity of all types of cars, he readily becomes efficient in estimating the total number of passengers, basing his estimate on the relation between the vacant seats and those occupied, or upon the total number standing added to the seating capacity, after satisfying himself that all seats are occupied. Usually two checkers can cover one point for the entire day, but in cases of very heavy traffic, assistance is needed during the rush periods.

The data thus collected should be turned in for tabulating or plotting at the end of each day if possible, and any irregularities in schedule should be followed up and causes noted.

Weather conditions are important and should always be noted for all parts of



PLAT *showing average traffic and service. This gives the average for a number of days of such observations as those shown on Plate B, the averages being taken of all cars passing within fifteen minute periods. The average number of seats in the same cars is shown by the dotted lines and the comparison of the two sets of lines shows the conformity of the service to the traffic.*

the day, and note should always be made of any abnormal occasion such as ball games, park music, etc., which might affect the normal riding characteristics.

Having obtained the data from the checkers, this information may either be tabulated or plotted in the form of a curve or chart with all necessary notation to insure a true record of all pertinent facts. While to the engineer the latter method is usually desirable, others may prefer that the results be put in tabular form. These results may either be plotted by single days or the average of the total number of days observed may be included. In plotting each day's results it is desirable to represent the number of passengers on each car by a vertical line drawn from a base and to space these lines to represent the time interval between cars. Cars bound for different destinations, or originating at different places, may be represented by different types of lines as desired. Such a chart is shown on Plate "B," and represents part of the actual observations for two days on one of the lines in Milwaukee.

In plotting the average results obtained over a number of days, it is necessary to average the number of passengers by short periods, preferably of 15 minutes, and to represent the average number of passengers per period by a horizontal line extending across the space allowed for each period. Such a chart is shown on Plate "C," which is the average for several days on the same line as is shown on Plate "B." Upon this same chart can then be plotted the average number of seats furnished by the operating company during the corresponding period, and, if desired, the number of seats required according to any predetermined standard can also be plotted on this same chart.

Here then will be a complete record of the traffic, the service rendered, the service required and such other miscellaneous data as bear on the cast. Obviously this record is applicable to conditions for a certain season only. Such a record is necessary for week days, for Saturdays and for Sundays, as well as for other seasons of the year when the traffic is not of the same magnitude. There are, of course, variations in the traffic due to general weather conditions. These can

usually be determined by general observations and the necessary steps taken for the required variations in the service.

Similar observations should be made at such points along the line as may be determined by circumstances. The principal purpose of these latter observations would be to furnish a basis for turning of cars which it is not necessary to operate the entire length of the line. The plotting of the data will be made in the same way as described for the point of maximum riding.

Standing by preference may refer to two different sets of riders. Certain persons may prefer to stand in a car whose seats are all taken rather than wait for a possible seat in a car following. There are also certain persons who prefer to stand even tho seats are available, provided they are permitted to ride in either the front or the rear vestibule. The proportion of last described passengers is quite large on certain types of equipment, especially if smoking is permitted in the vestibules and prohibited in the body of the car. As this preference may have a bearing on the amount of equipment necessary for satisfactory service, it is essential that checks be made. This can be done by careful count of persons standing when part of the seats are vacant, observing at the same time the total number of passengers riding, for the purpose of obtaining a percentage. The number of seats in the car must also be recorded, as the ratio of persons standing is affected to some extent by the number of seats vacant. Recent observations have shown that for cars with cross seats the ratio increases quite suddenly when about 50 per cent. of the seats have been taken, that is when there is an average of one person on a seat which normally is large enough for two. It is highly important that a complete description of equipment, company rules, etc., which in any way may affect this habit of standing must accompany any data of this sort, for it is obviously useless for instance to expect to find persons standing by preference in a closed car on which smoking is prohibited, and where passengers are never permitted on the front platform and only on the rear platform when the body of the car is so full that no more can enter.

It is not necessary here to go again into detail as to uses to which these data may be put. Too many schedules have been made in the past on anything but scientific bases. As stated above, the results demanded of the present day manager will no longer permit him to operate his railway by rule of thumb. The public is an interested party on one side and the manager representing the interests of his stock and bond owners is the interested party on the other side. Both must be recognized, and in order that full justice may be done to all, and that modern conceptions of the necessity of using all known means for the avoidance of waste and loss may receive due consideration, modern and scientific methods should be used to determine what is fair as between the parties directly interested, and what most nearly conforms to modern ideas of true economy. With the data collected and tabulated or plotted in serviceable form the manager or operating officer will at all times know whether or not he is doing justice to the position he holds.

As a sample of a schedule made up to give service as required and still avoid dead car mileage, the following table shows the variations in headway on the Court Street line in the city of Brooklyn, taken from testimony of Geo. L. Fowler, before the Railroad Commission of Wisconsin, May 6, 1912:

Time—			*Headway—*
5:00	to	5:36 a. m.	7.2 minutes
5:36	to	5:48 a. m.	6 minutes
5:48	to	6:00 a. m.	4 minutes
6:00	to	6:18 a. m.	3 minutes
6:18	to	6:52 a. m.	2 minutes
6:52	to	9:00 a. m.	1.6 minutes
9:00	to	9:12 a. m.	3 minutes
9:12	to	3:26 p. m.	4 minutes
3:26	to	4:00 p. m.	3 minutes
4:00	to	4:30 p. m.	2 minutes
4:30	to	6:12 p. m.	1.6 minutes
6:12	to	6:26 p. m.	2 minutes
6:26	to	7:00 p. m.	3 minutes
7:00	to	8:00 p. m.	3.2 minutes
8:00	to	11:00 p. m.	6 minutes
11:00	to	12:50 a. m.	15 minutes
12:50	to	1:08 a. m.	16 minutes
1:08	to	4:28 a. m.	20 minutes
4:28	to	5:00 a. m.	16 minutes

STEEL SHEET PILES IN EXCAVATION WORK

By Jules R. Breuchaud, President of The Underpinning and Foundation Company, New York City.

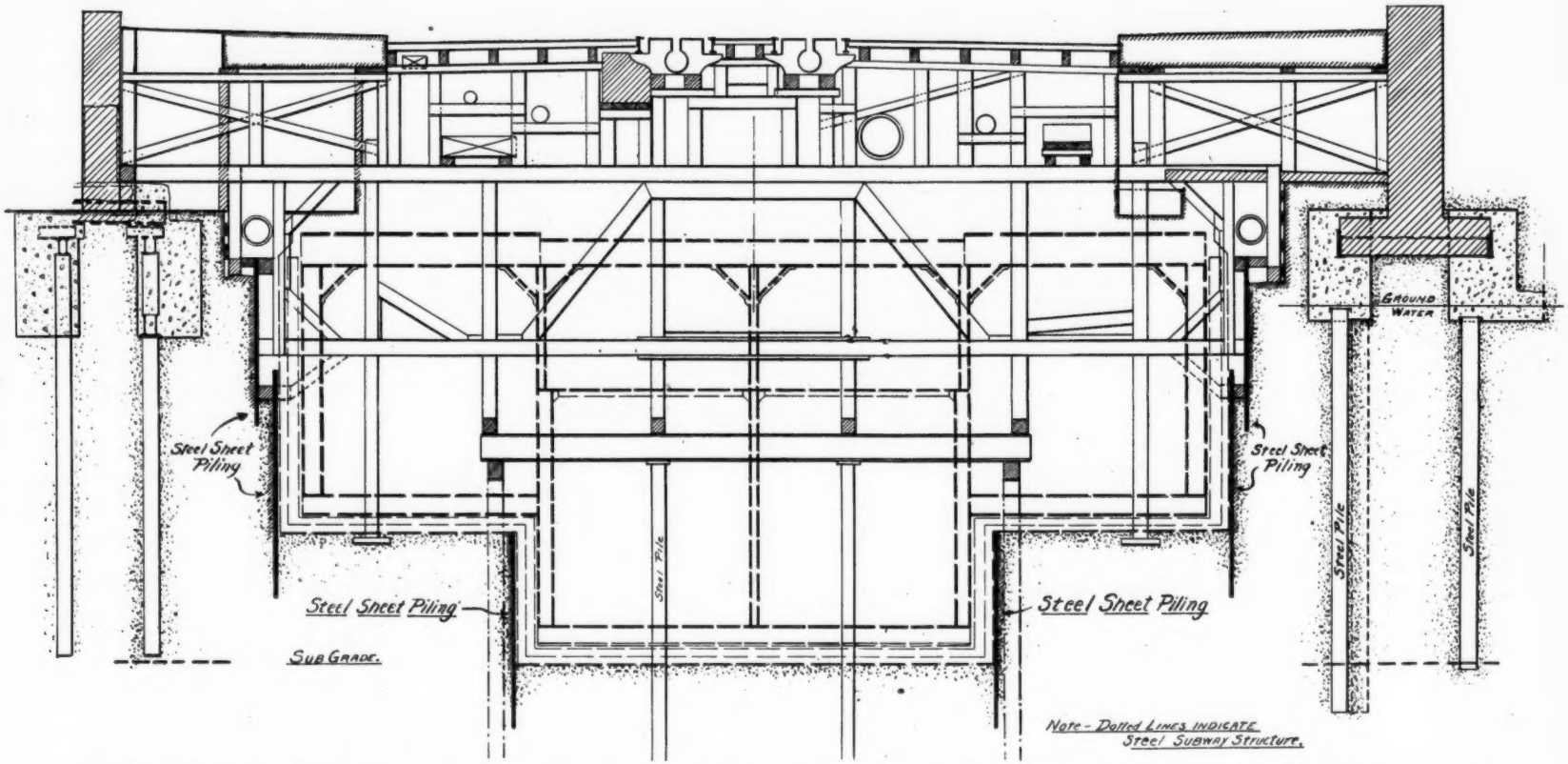
This description of the successful use of sheet steel piles in retaining the earth on the outside of subway and warehouse excavations demonstrates that the Chicago accident reported in our January number was unnecessary, since proper design and carefulness in installation will render the sheet steel retaining walls of such excavations absolutely safe.

IN important foundation work the difficulties of excavating in quicksand and soft wet soil in Greater New York necessitate the use of various forms of sheeting to retain the sides and to exclude water. Many years of experience of the Underpinning and Foundation Co. have included the application of several types of sheeting, and those that proved most efficient and satisfactory for the very delicate work on which the writer has recently been engaged, the conditions prevailing, the methods employed, and the results obtained, are here described. The steel sheet piles were a vital element of success in the difficult work here referred to that aggregates $2,500,000, and the care in selecting and installing them adds to the value of the unusually good results obtained.

Section 3 of the Broadway-Lexington avenue subway extends about one-half mile along Broadway from Houston street almost to Bleecker street. The material encountered is a brown sand varying from very fine texture, sometimes with a small percentage of clay, to a coarse variety, and in places running to a clean gravel mixed with sand and small boulders. Rock in the locality is from 45 to 70 feet below the surface and therefore is not encountered in this section of the subway structure, as subgrade varies from 26 feet to 40 feet below street surface. Ground water was not encountered at the north end of the work, but at the south end it stood at about 18 feet below street level.

The reason for the greater depth of the subway at the southerly end of the work is due to the fact that the two center or express tracks start to grade down about 900 feet from the south end, and at this end are 14 feet below the outside tracks. This depression is required for a future physical connection with a proposed cross line of subway at Canal street.

Under the present method of constructing subways, the street surface decking, trolley tracks, and sidewalks are maintained on timber posts and beams while the excavation is being carried on beneath. Not only are the street surface structures thus supported, but all the sub-surface structures, of which there are many, such as water pipes and sewers, telegraph, telephone and electric ducts, as well as heavy walls under the street and sidewalks, are similarly carried. It is, therefore, evident that when working in sand, and especially water-bearing sand, great care must be used in supporting the surface and sub-surface structures to prevent settlement. For this reason and to prevent absolutely the movement of the soil from beneath heavy buildings adjoining the work, sheeting at the sides of the excavation is necessary.



TYPICAL PLAN OF TIMBERING *for subway excavation at Grand street, New York City, showing the use of steel piling for retaining the earth. Note the proximity of the buildings to the excavation and the necessity of holding the earth absolutely to prevent settlement. The broken lines indicate the steel subway structure, above which earth and concrete will be filled in, all other structures and materials shown in the excavated space to be removed up to the surface of the street.*

The outside lines of the subway are about 7 feet from the building line, and the excavation and timbering are first carried approximately to the level of the foundations of the buildings along the work. These buildings are then underpinned to subgrade of subway, sheeting driven at the extreme neat or side lines of the subway structure, and excavation then carried down to sub-grade for the placing of concrete on which the steel structure is to rest. The open cut between parallel lines of sheeting is about 60 feet.

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¶ WHERE EARTH *was solid wooden sheeting or concrete in pits was used to confine it.*

Along the north and central portion of the work, either 3-inch wooden sheeting was driven or a continuous series of neat line pits were sunk to 1 foot below subgrade and concreted in conjunction with the underpinning of the buildings. A continuous wall was thus formed, which, when excavation was carried to sub-grade for the subway structure, served the triple purpose of doing away with the sheeting, maintaining the material in front of and beneath the buildings adjoining, and forming a wall on which the permanent cast-iron pipe sewer was to be built. At the southerly end of the work, where water-bearing sand was penetrated, and greater depths were reached, the question of maintaining the ground at the sides of the excavation was a more difficult and serious problem. Several types of steel sheeting were considered and but two types were adopted.

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¶ WITH WATER BEARING SAND *steel sheet piles were used.*

The Wemlinger corrugated sheeting used was ⅛ inch thick and 12 inches wide, and the spring lock sheeting was ¼ inch thick. After excavating down to ground level and completing the underpiping, a trench about 4 feet deep was dug at the extreme neat lines of the subway, 5-inch by 10-inch wale pieces placed, and the steel sheeting set up to line and plumbed ready to drive.

The Wemlinger sheeting was driven in 10-foot lengths by means of a McKiernan 600-pound compressed-air hammer, and as friction developed from increased depth of penetration, a 1,500-pound McKiernan hammer was used. A steel shoe was used to receive the blow from the hammer.

Owing to the thoro and careful bracing, very little trouble was experienced in regard to alignment. Of course, it is understood that an inch or so for play was allowed. The driving was slow, due to the cramped condition of working space, and if a heavier hammer could have been easily and economically handled it would have taken the place of the lighter type and expedited the work.

In this line of work, interlocking steel piling had an added advantage in that it can be driven to a neat line. The only area that is lost is the distance that the flat rivet heads keep the face of the piling from the waling piece, which is set on a neat line. On a large job, such as this work, where concrete is to be placed against the piling, this reduced area effects a saving in concrete.

Another important feature of the type of interlocking steel piles as used on this work is their ability to engage the interlock of adjacent units by side entrance, thus effecting a saving of the full length of the pile in necessary vertical clearance. This property proved to be of great value on this work, in a covered trench where 20-foot lengths may be assembled and driven in 25-foot headroom.

The Wemlinger corrugated pile has a very small section which greatly reduces the weight per square foot of wall surface, and if the conditions will allows it to be pulled, it can be used several times, if the driving is not too hard or severe. On account of the subway construction and interference of timbering, vault walls and other sub-surface structures, it will be impossible to remove any of the piling, which means that about 18,000 square feet of it will necessarily be left in place.

The pumping stations of Section 3 and of Section2-A, the adjoining contract, are close, and the combined pumping capacity

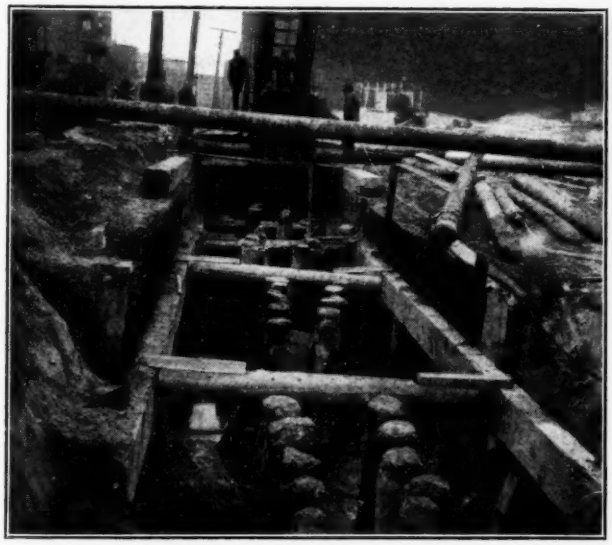
amounts to 2,000 gallons per minute, using electrically driven centrifugal pumps. Pumping has been going on continually for about a year, and the water level has been lowered about half the required depth. It may be necessary to resort to the pneumatic process for the lower cuts, as the pumps so far do not seem to be effective for the lower depths. Driving the steel sheeting 4 feet below sub-grade has proved effectual in holding back the sides of the excavation and preventing movement of material below the bottom of the sheeting. Of course, the bottom of the subway excavation cannot be made tight by sheeting and bracing of the sides of the cut.

After driving sheeting at the side of the excavation, a sump was excavated and the water was carefully drawn down by steady pumping, in order to lessen the risk of rapid ground flowing, or of carrying fine material thru the pumps. Such loss of material might have caused dangerous settlement of buildings.

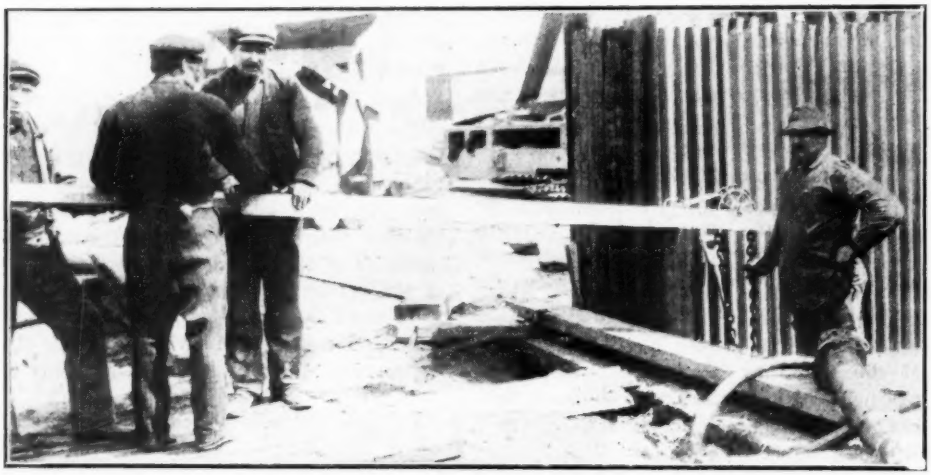
In order to lessen this hazard, and to assist free drainage, a double line of steel sheeting was driven to form a drainage trench connecting with the sump. The bottom of this was lowered a few inches each week by excavation. When there was any indication of "boiling" or of bubbling up of material, then lowering of the bottom of the trench was immediately discontinued and the water allowed to rise, and it was maintained at a level at which further "boiling" did not occur.

The steel sheeting was driven in two stages at the neat lines of the excavation, and after the ground water had been lowered by pumping to the level of the sub-grade of the outside or local tracks, excavation was removed down to this level in the two outside tracks. Steel sheeting was then set up as before and driven on the outside lines of the central or express tracks to a depth of about 4 feet below sub-grade in order to maintain the outer tracks. This required sheeting varying in lengths up to 20 feet.

After this sheeting has been driven and if the water level can be lowered without resorting to the pneumatic process, the excavation will be completed, and the concrete for the subway floor placed, which will tend largely to seal the bottom, as the steel sheeting has stopped the flow of water from the sides of the excavation. This work is now going on without incident, and with entire satisfaction. If the water cannot be lowered without loss of material from the open cut, a roof will be placed on the steel sheeting at the sides of the excavation, cross steel sheeting driven at the ends, air locks installed, and the work completed under air pressure. The present vertical sheeting would thus form the sides of the caisson, the joints between the sheet steel piles being easily sealed with a coating of tar. After the permanent concrete bottom had been placed and sealed, the roof would then be removed to allow the subway steel to be erected.



TRENCH *for east line of piers on Franklin building, showing driving of foundation piles and use of sheet piling in excavating trench for concrete piers and walls.*



METHOD OF DRIVING *sheet steel piling with water jet and the lever, chain and pawl shown.*

Wemlinger steel sheet piling was used to great advantage in connection with the underpinning of many of the buildings along this section. At the southerly end of the work in the water-bearing ground, the Breuchaud method of sectional pipe pile underpinning, which requires no sheeting, was used very satisfactorily with no perceptible settlement of buildings, but at the north end in the dry sand, pits sunk alongside the foundation of the buildings were sheeted with Wemlinger piling in lengths from 4 feet to 10 feet, driven with hand mauls. It was imperative that no ground whatever be lost, as the column loads were often 300 to 600 tons each, and these pits were driven directly adjoining or below the spread footing. After concreting and transferring the column load to this new extended foundation, the steel piling was left in place.

The work of constructing Section 3 has not yet been completed, but it will be of interest to remark at this time, as an evidence of the safety and success of this work at present, that it was recently given the severest test possible in two of the heaviest rainfalls that have occurred in New York City in years, on September 4 and October 1. The permanent Broadway sewers, taxed to their capacity, could not begin to handle the run-off, consequently a dangerous and violent flooding of the excavation occurred, and it is proof of the great care used in the underpinning of the buildings and the maintaining of the ground by the steel sheeting, that no settlement of the buildings occurred, tho the flood waters filled the excavation to depths of 20 feet and 12 feet respectively on these two occasions.

A considerable amount of steel sheet piling was driven in connection with the construction of the piers and wall foundation for the Franklin and Nye Buildings, two 470 x 80 feet, 6-story concrete steel construction storage warehouses, built for the New York Dock Company at Atlantic Basin, Brooklyn, in 1911-1912. The foundations of the buildings rest on over 500 wood piles 25 to 30 feet long. There are 112 central columns and piers and a continuous outside wall footing for each building. The material on which the buildings rest is a firm, compact sand, and the warehouses are about 200 feet back from the wharf. Street level is about 4 feet above mean high tide.

As soon as excavation was commenced and wood sheeting started in some of the piers it was found impossible to lower the water level by pumping, as the water rose and fell with the tide, and the sheeting was not close enough to exclude the water. At the commencement of the work the piers were started by driving 3-inch tongue-and-groove spruce planks to depths of about 10 feet, the bottom level of piers. It was soon found that owing to compact-

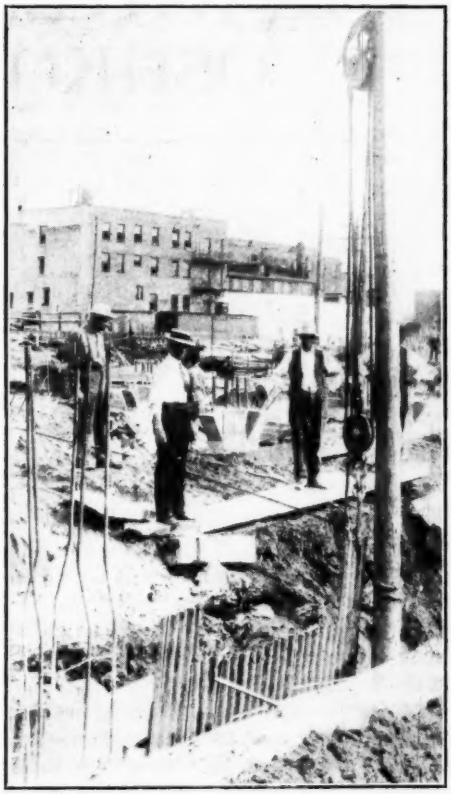
ness of the material, it was so difficult to get the sheeting down, either with mauls or light steam hammers, that the further use of wood was abandoned as impractical,, expensive and too slow.

Wemlinger steel sheet-piles, ⅛ inch thick, 12 inches wide, weighing 7½ pounds per foot were then used, driving being done in 10-foot lengths. Hand mauls and steam hammers were again tried, but the process was too slow and a water-jet and a lever to force the pile down were tried and found to work successfully.

Usually a pier was started by setting all the sheet-piles in place betwen the ranger and guide plank. They were then forced down by means of a wooden lever about 15 feet long placed upon the pile about to be driven so that the latter formed the fulcrum against which the lever acted. The short end was mortised for a 12-inch iron sheave about 2 feet from the sheet pile, and over it passed a chain with a hook which could be fastened to the ranger, the other end of the chain, terminated with a large iron ring, remaining loose, and would be pulled up as the lever was lifted. Fastened to the top side of the lever was an iron pawl which was hinged so as to engage in the chain, locking it in position, thus acting as a ratchet as the sheeting was forced down.

After setting the sheeting in position, the lever was placed on the pile and the hook fastened to the ranger, and three men would apply weight to the long arm of the lever as the water-jet loosened the material at the foot of the pile. Five men handled the work of jetting and driving sheeting, and an average of 70 pieces of piling were driven per day. Over 70,000 square feet of sheeting were driven by this method, and the same sheets were used several times.

A number of the piers and a considerable part of wall trench were first sheeted and excavated in advance, and the wood piles, which varied in number from 10 to 24 per pier, were then driven and cut off at proper grade. The column bases or wall footings were then concreted and the sheeting pulled and re-driven in another part of the lot. Some of the foundations extended to a greater depth for the location of boiler room and basement.



PULLING STEEL SHEET PILING *is simple with a gin pole and a small engine.*

The advantage in using steel sheeting is evident both in the actual excavation work, which was greatly delayed by the use of wood sheeting, and in the great saving in cost, for, while wood sheeting could be used but once because of the severe driving, the steel sheeting was used not only on this work, but has since been used elsewhere on later contracts.

The cost of driving the sheeting was about 2½ cents per foot. The sheeting was pulled by a 5-part tackle, operated by means of a gin-pole and small swinging engine, requiring four men and a foreman. In this way an average of 90 piles were pulled per day at a cost of 1½ cents per square foot of pile.

THE WATER WORKS OF OSHKOSH, WIS.

A critical study of a water works plant under private ownership, made by competent engineers, shows the needs of the system and enables the inference to be drawn as to the reasons for the present condition. It will be of value in the negotiations pending for purchase of the plant by the municipality and as an example of the study that should be made under similar circumstances elsewhere.

THE city of Oshkosh, Wis., has a population of about 34,500, estimating the increase since 1910 at about 1,500, and is a prominent center for manufacture of articles made of wood, its output of sash, doors and blinds, for example, being greater than that of any other city in the country.

The city adopted the commission form of government and its three commissioners have terms of six years, one being chosen at each biennial election.

The city is located on Lake Winnebago and on both sides of the Fox river, and is built upon about three-fourths of the area of 7.9 square miles included within the city limits. It has 5.9 miles of asphalt paving, 2.9 miles of brick, 1.8 miles of cedar block and 1.1 miles of other kinds of paving, and other streets are improved with tar macadam to the extent of 5.3 miles, water-bound macadam 16.0 miles, and gravel 19.0 miles, making 52 miles of improved streets. There are 50 miles of unimproved streets and 17 miles more which are platted but are not in use.

The waterworks plant is owned and operated by the Oshkosh Water Company and was first built in 1883. Since the commission form of government was adopted the city has voted to buy the plant, but the final action has not been taken. The Wisconsin Railway Commission, which is the public utilities commission of the state, has made a valuation of the plant which can be used as the basis of the negotiations for the purchase.

At the present time the works are in the charge of the president of the company, W. G. Maxcy, who has been with the company for almost its whole active existence. Complete and accurate records are kept of the distribution system and of the performance of the pumping station and other details, so that quite full information was on hand on which to base the physical valuation of the plant and the judgment of the proper cost of maintenance and operation.

As the plant now stands it may be described as follows: Lake Winnebago is the source, having a watershed draining over 6,000 square miles and varying little from its average level, thus furnishing an inexhaustible supply. The intake is a 24-inch riveted boiler-iron pipe, terminating in three perforated copper conical points turned up in a depth of 16 feet of water 800 feet from shore, connecting thru 131 feet of cast-iron pipe to the pumping station. A 16-inch cast-iron emergency intake extends from the station 131 feet to a 6-foot circular cistern in 5 feet of water. Anchor ice has given some trouble, but has never seriously interrupted the supply.

The intake discharges into a 400,000-gallon sedimentation basin, 10 feet deep, and the water is raised thence to the filters thru a 12-inch pipe by a 3,000,000-gallon Lawrence single-stage, low-lift, centrifugal pump directly driven by 15-h.p. Westinghouse engines. There is a duplicate pump, and water can be drawn directly

from the intake pipes when the sedimentation basin is out of commission.

There are 12 Warren filters of 8.75 feet diameter and 2 Jewell, 15.25-foot, wooden tank, gravity filters, the total capacity being 3,000,000 gallons a day, the same as one pump. The discharge from the filters is thru a 16-inch pipe to a clear-water basin 15 feet deep of 1,250,000 gallons capacity or to a circular brick concrete-lined pump well, 24 feet deep, of 18,000 gallons capacity. Large emergency pipes connect basins and pump well and the layout of gate valves and piping is complete and adequate for any emergency.

The pumping station, adjacent, is at the foot of Washington street, a mile from the business center, and supplies the entire city under direct pressure. The operating floors are well above high water in the lake.

¶ THE EFFECT *of the introduction of a comparatively small proportion of meters has been quite marked.*

The pumping equipment, installed when the works were built, includes 2 Gaskill, horizontal, crank and fly wheel, compound, duplex, double-acting, 4,000,000-gallon pumps, which are used alternately, each running one month at a time and kept warm during its idle time, ready for operation. There is also a 1,500,000-gallon Worthington, horizontal, compound, duplex, double-acting pump in reserve, which was erected in 1888. There are 4 Battis Bros. 80-h. p. boilers, of later dates, 2 of marine type erected in 1899 and 2 tubular type erected in 1901. Three steam pipes supply the 2 Gaskill pumps, the centrifugals, and the Worthington respectively, and the Worthington is also connected with one of the Gaskills.

The effect of the introduction of meters upon the consumption of water is shown by the following table:

This table shows a very pronounced diminution in the consumption per capita, some 25 per cent, and almost a doubling of the number of meters in the same period, but there has been in the same time an increase in the number of services which is almost the same in number as the increase in number of meters. It might be deduced that a small increase in proportion of metered services produces a large decrease in consumption per capita, and this will occur if the new meters on old services are judiciously located. If instead of number of services, number of consumers had been reported, the comparison would be more satisfactory, for the services not in use would not then act to reduce the percentage of increase in possible sources of reduction in waste. If actual waste is to be studied the number of services should be considered, but if reduction in waste is the consideration the number of sources of possible reduction is the basis, that is, the number of services thru which water is supplied to consumers.

The maximum consumption of water recorded was 5,325,480 gallons in 24 hours on Jan. 14, 1913, during a fire lasting 20 hours. This was much beyond the filter capacity and somewhat more than the capacity of one pump. The maximum consumption at normal pressure was 3,618,000 gallons in 24 hours on July 8, 1911, again beyond the filter capacity but within the capacity of either of the two larger pumps. During tests of capacity of the system for fire protection it developed that the consumption increased from 3,360,000 gallons a day at the normal pressure of 41 pounds, to 5,530,000 gallons at the fire pressure of 100 pounds.

It has been recommended that 2 5,000,000-gallon pumping engines, usable on either high or low-pressure work, be

CONSUMPTION OF WATER IN OSHKOSH, WIS.

Year Ending June 30.	Daily Consumption, Gallons.	Estimated Population Supplied.	Gallons per Capita.	—Number of— Services.	Meters.
1909	3,004,000	32,300	93	2,921	628
1910	2,561,000	32,800	78	3,086	738
1911	2,525,000	33,300	76	3,243	880
1912	2,607,000	33,800	77	3,344	1,033
1913	2,367,000	34,300	69	3,393	1,166

installed for safety in case of breakdowns and repairs.

The pipe distribution is shown in the accompanying table:

DISTRIBUTION OF PIPE IN OSHKOSH WATER SYSTEM.

Diameter. Inches.	Length. Miles.	Percentage of total.
4	7.40	13.5
6	34.56	62.9
8	6.78	12.4
10	2.65	4.8
12	2.48	4.5
16	1.05	1.9
Total	54.92	100.0

The map of the pipe system shows that the main from the pumping station, 16-inch diameter, is too small and the branches to the lumber and manufacturing districts are insufficient. In the small distribution main system the connections between intersecting pipes are too far apart, making the system weak in time of fire protection demands. The Fire Underwriters' engineers recommend an additional 12-inch supply main from the pumping station and 8 to 12-inch feeders in different directions so as to insure fire supply amounting to 4,000 gallons a minute at 75 pounds pressure anywhere within the principal mercantile district, 2,500 to 5,000 gallons in the different lumber and manufacturing districts as they may require and 1,500 to 2,500 gallons at 60 pounds in any block in the residential districts, in addition to sufficient capacity for the ordinary consumption. They make also their standard recommendations that the minimum size of mains where fire protection is needed be 6 inches where there are frequent connections at intersections and 8 inches where dead ends and lack of cross lines are likely to be the conditions for some time, and especially in blocks 600 feet or more in length; that in mercantile, lumber and manufacturing districts the minimum sizes be 8 inches, with numerous cross connections, and 12-inch where they are lacking; and that 4-inch pipes and dead ends be eliminated as rapidly as possible.

Other standard recommendations of improvements are made, including addition of gate valves so that a break will not require shutting off more than 500 feet of pipe in important districts and 800 feet in others, the present lengths running from 1,400 to 2,300 feet in important districts and 1,440 to 4,500 feet in residence districts.

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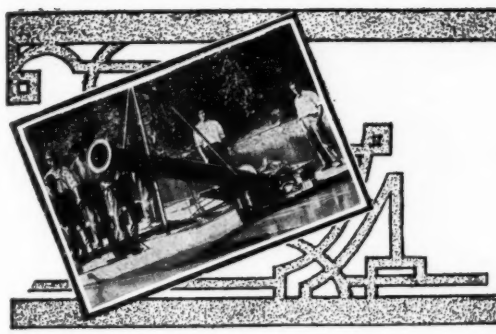
¶ HYDRANTS *are the important feature of fire protection and should be numerous and have proper outlets.*

Hydrants should have 6-inch barrels, 6-inch gated connection to main, 5-inch foot valve and one 4½-inch and two 2½-inch outlets. It is also recommended that in mercantile, lumber and manufacturing districts there be 2 hydrants at each street intersection and intermediates where blocks are over 350 feet long; and in residence districts one hydrant at each street intersection and additional hydrants enough to bring the distance between hydrants down to or below 350 feet. Threads should conform to the National standard. The system now has 484 hydrants, averaging 330 feet apart in the mercantile district and 535 feet in the residence district, each hydrant serving 2½ acres in the former and 4 acres in the latter districts.

The water company has noted no trouble from electrolysis, street railway rails being well bonded and recently renewed, tests of bonding made annually and the last one showing no electrolytic activity.



EDITORIAL

PROMOTION OR BONUS STOCK IN PUBLIC UTILITIES.

The address of President Winslow before the Wisconsin Electrical Association, an extract from which is on another page, touches upon a subject which is under frequent discussion by promoters of public service companies and presents the common view taken by them. There is neither time nor space here to enter into a discussion of the question, but one suggestion may be made with the hope that it will arouse thought and discussion.

It is now conceded by practically every one that the judicious control of the public service utilities which is exercised by the Wisconsin Railroad Commission and by other bodies with like responsibilities and ability to sustain them, has resulted in a stability in the securities of such companies which more than compensates for any disadvantages arising from such control. In other words, the methods of doing the business of public service corporations have been changed and established upon such a uniformly sound basis that their stocks and bonds have been taken out of the speculative class and are now safe and stable investments.

Mr. Winslow would have us believe that there must still be a speculative feature in the starting of a public service industry, but it is fair to ask why this speculative feature is any more necessary in the starting of such an industry than in its subsequent operation, and at what stage in its proceedings the speculative feature must be dropped and the water squeezed out, for, that all the promotion expenses beyond certain legitimate organization expenses and commissions must be eliminated, has been definitely demonstrated by the public service commissions in their investigations on which to base schedules of rates. Mr. Winslow's address does not give any fundamental reason for changing this decision.

Must not the change in methods of doing corporation business be made in their organizations as well as in their subsequent operation? Is not the ordinary promoter wisely barred from operation under a public service commission? He often promotes for his own benefit without reference to the possible loss of those whom he interests in his schemes, certain loss sometimes, because there is really no speculation about it, no matter what the prospective investors may think.

Is it not better, in the beginning, to wait until there is a real demand for the service proposed, even until the local business men and investors are ready to take up the matter in earnest and invest in the company, until the speculative feature is reduced to a minimum by the development of the demand and the procurement of as many advance contracts for the service as possible? Once in a while the development of a town will be delayed by this course of action, but not often.

There is no lack of local interest in the starting of a public service cor-

poration on a reasonable showing of profit not too far in the future, even if it is to be in competition with other similar industries, provided the possibility of manipulation of stocks for the benefit of a few is eliminated, as is demonstrated by the prompt success in the establishment of such corporations as the Consumers' Gas Trust Company in the natural gas field in Indianapolis more than twenty-five years ago, and its recent successor in the artificial gas field, the Citizens' Gas Company.

If the possibility of speculation in the stock is removed, the speculative remainder in the doubts regarding the amount of business available will be almost negligible for any one with business ability enough to be trusted with the organization of such a company. It would seem that the proper field for legislation is in the line of proper protection of the stock of public service corporations from speculative manipulation rather than in letting down the bars to speculation and manipulation. There seems to be no reason why the plan so successful in the voluntary associations named should not be enacted into permissive legislation, if not compulsory upon persons wishing to form public service corporations.

THE AMERICAN CITIZEN IS NOT DEMOCRATIC.

The reply of Mr. Mayson, to be found on another page of this number, to Mr. Bradford's article on the commission form of government, which appeared in the December number, suggests the reiteration of the statement that the average dweller in the American city does not care to be bothered with the city government, and much prefers to be governed, provided he himself is not interfered with. And the larger the city the more pronounced is the expression of this state of mind.

MUNICIPAL ENGINEERING has often expressed its opinion that the form of government is not so important as the demonstration of interest in the government by the people. A scientific form of government is always to be desired, because it is easier to administer such a form, but at the same time it is easier to maladminister such a form.

We take more interest in our national government than in our local city government, more in our state government. The interest manifested seems to be in inverse proportion to the nearness of the government to our own affairs, with the possible exception of the county government, which is even more neglected by the average citizen than that of the city.

Possibly this is because the ballot is shorter. Mr. Mayson seems to overlook the observed fact that the average voter is not able to consider intelligently more than, say, three or four names on a ballot. If there are more, he is likely to vote the ticket in block rather than individually, if there is any chance to group the names. Really this seems to be the only advantage of the commission form of government, and, like the others named, this is not the exclusive property of that form. We do get better men, on the whole, when we vote for only one, two or three at a time, than when we vote for more.

What we really need is more interest by the voters in their city government. And the thing which will do more than any other external influence to aid in the extension of this interest will be such change in the machinery of nominations and elections as will give the voter some hope that his opinion has a chance to be recorded in selecting the candidate. But this will be of no value unless the change in the state of mind of the voter is made and he really takes an interest in every step of the process. Atlanta has good results because its citizens do take an interest in its welfare and its city government.

February, 1914

QUESTION DEPARTMENT

Manufacturers of Wood Block for Street Paving

Would you mind sending us a ilst of manufacturers of wood block for street pavements? Thanking you in advance for the favor, we are, B., Evansville, Ind.

Manufacturers of wood blocks and creocoters of blocks for pavements are quite numerous. Among them are the Yellow Manufacturers' Association, 711 Wright building, St. Louis, Mo.; U. S. Wood Preserving Company, 165 Broadway, New York City; Barber Asphalt Paving Company, 806 Jackson boulevard, Chicago, Ill.; Kettle River Company, Minneapolis, Minn., and St. Louis, Mo.; Jennison-Wright Company, Toledo, Ohio; Wyckoff Pipe and Creosoting Company, 50 Church street, New York City.

Ordinance Governing Trees in Parks and Streets

The Noon Civics Club of this city propose a campaign of education among the people of Fort Smith as to the care of trees and parkage in the city and hope to be able to prevail upon the city government to pass such ordinances as will have the effect of caring for and preserving the trees, beautifying the parks, etc.

I understand that you have from time to time published articles treating on these subjects, also that you have published ordinances passed in different cities covering these matters, and I am writing you with a view of securing copies of these publications.

H. T. Smith, ——, Ark.

Articles in MUNICIPAL ENGINEERING upon these subjects have appeared at intervals during the past four years in particular. They include the following:

In vol. xlv, p. 367, on maintenance of fire department grounds; p. 445, on how to lay out a small city park.

In vol. xliv, p. 482, on protecting trees from insect pests; p. 134, on irrigated trees; p. 143, on effect of parks and playgrounds on real estate values; p. 425, on ordinances requiring weed cutting and refuse removal; p. 37, on ordinances governing poles and wires; p. 232, on ordinances requiring ornamental trolley poles.

In vol. xliii, p. 262, on tree surgery; p. 233, on the tussock moth; p. 126, on a power machine for spraying trees; p. 326, on designing a street for a small city; p. 297, on Chicago's recreation centers; p. 254, on ordinances requiring weed cutting and refuse removal; p. 81, on ordinances regulating bill boards.

In vol. xlii, p. 249, on ordinances for removal of obstructions from the street.

There are numerous articles on tree planting in streets, care of street trees, effects of pavements and sidewalks on trees, municipal control of shade trees by law and by ordinance and the results thereof, in earlier numbers.

A good book on the subject is Solotaroff's "Shade Trees in Towns and Cities" ($3). Another book that may be of use in one branch of the work is Mero's "American Playgrounds" ($1.70).

A recent ordinance providing for cooperation between city and property-owners in planting trees and for municipal control of planting and maintenance reads as follows:

An Ordinance Creating the Park, Tree and Flower Commission of the City of San Leandro, Prescribing the Duties of Said Commission, and Fixing the Penalties for Violation of the Ordinance.

The Board of Trustees of the city of San Leandro do ordain as follows:

Section 1. A commission of subordinate officers is hereby created to be known as the Park, Tree and Flower Commission of the city of San Leandro. It shall be comprised of five members, including the president of the board of trustees and four others appointed by said board, at least two of whom shall be women.

They shall hold office for two years, commencing May 1, 1910, and until their successors have been duly appointed; provided, however, those first appointed under this ordinance shall so classify themselves by lot that two of them will

go out of office at the end of the first year, towit: May 1, 1911.

The members of the Park, Tree and Flower Commission shall not receive any compensation for their services.

Sec. 2. The Park, Tree and Flower Commission shall hold regular meetings at least once every month; special meetings may be called by the chair or upon request of two members.

At the first meeting in May of each year they shall elect a secretary and a treasurer. The secretary shall keep a complete record of all the proceedings and attend to all correspondence. The treasurer shall have charge and custody of all funds, and shall keep an account of all receipts and disbursements. The president of the board of city trustees shall be ex-officio chairman of the commission and shall preside at all meetings. In case of his absence a chairman pro tem. shall be elected by the other members of the commission.

Sec. 3. The Park, Tree and Flower Commission shall have full and complete charge of the planting, trimming and care of all trees, palms and flowers on the streets, sidewalks and parks of the city. They shall encourage the planting of ornamental trees, palms and flowers, not only on the public streets and parks, but also on the private grounds of our residents; and for the latter purpose, in order to stimulate friendly rivalry, they may award cash prizes for the most successful, either to children or adults, or both.

Sec. 4. Whenever in the judgment of the commission, it is deemed desirable to plants trees, palms or flowers upon any street or portion thereof, or whenever a petition or request therefor has been made by a number of the owners of real property fronting thereon, the commission shall secure from the city book a list of all the owners of real property fronting on such street or portion thereof, and send them a written or printed notice through the United States mail, requesting them to attend a meeting at a certain time and place specified in such notice.

The chairman of the commission shall preside at such meeting and call upon the property owners in attendance to express themselves and determine by majority vote of those present whether trees, palms or flowers, if any, shall be planted on their street.

If a majority of the property owners present at such meeting decide in favor of a certain kind of tree, palm or flower, the planting of which is not prohibited by ordinance, the chairman shall call upon each and every one of them to sign an agreement in writing to pay a specified sum, amounting to their proportion of the cost thereof, based upon the amount of frontage owned by each of them respectively, which sum shall be payable within thirty days after such trees, palms or flowers have been planted.

Thereupon, and before adjourning the meeting, the chairman shall appoint a committee of three property owners from among those present to wait upon the remaining property owners on such street who failed to attend the meeting and secure their signatures to the aforesaid agreement.

After said agreement has been returned to the chairman with all the signatures obtainable the commission will prepare a written report to the board of city trustees, informing them of the trees, palms or flowers required. Such report shall contain the name of the street, the total frontage to be planted on both sides thereof, and the number and kind of tree, palm or flower required.

The trustees will thereupon cause the city clerk to secure bids from not less than three well-known nurseries, upon receipt of which the contract will be awarded and the trees, palms or flowers purchased; and upon arrival they shall be planted under the direction of the superintendent of streets.

Sec. 5. All trees or palms under the provisions of this ordinance should be set back from the street corners so as to give the least amount of obstruction to street lights. They should be planted a certain distance apart, according to the size they usually attain at full growth. All trees, the branches of which usually spread to the extent of twenty feet from the trunk at full growth, such as the locust, should be set back twenty-five feet from the corners (measured from the property line) and placed at least fifty feet apart.

All trees, the branches of which usually spread to the extent of twelve feet from the trunk at full growth, such as the mountain ash, should be set back fourteen feet from the corners (measured from the property line) and placed at least thirty-five feet apart.

Palms should be planted not closer than twenty feet apart.

It is expressly understood, however, that the provisions of this section shall not apply where young trees or palms are planted between old or decadent trees.

Sec. 6. It shall be unlawful for any person to plant, trim or remove any tree, palm or flower growing on the streets, parks or public grounds of the city of San Leandro, or wilfully injure or destroy the same.

Sec. 7. In order to assist in carrying out the objects of this ordinance the city trustees may levy and collect a tax not exceeding two cents on the one hundred dollars valuation of all real and personal property in the city, to be known as

the park, tree and flower fund, payable to said commission on request.

Sec. 8. Whenever a street is planted with trees or palms under the provisions of this ordinance, and the expense thereof paid for by the property owners as therein provided, their trimming, nurture and future care shall be paid for thereafter out of the public funds of the city.

Sec. 9. Every person violating any of the provisions of this ordinance shall be punishable by a fine not exceeding one hundred dollars, or by imprisonment in the city jail or the county jail of Alameda county not exceeding three months, or by both such fine and imprisonment.

Sec. 10. All ordinances or parts of ordinances in conflict herewith are hereby repealed.

Sec. 11. This ordinance shall take effect from and after May 1, 1910.

Cost of Cincinnati Pavements

A year or so ago you published some figures on the comparative costs of several different kinds of pavements in Cincinnati.

Will you kindly tell me where I can find these articles? B., ———, Ind.

On page 458, vol. xlii, of MUNICIPAL ENGINEERING, June, 1912, is a report by James E. Barlow, the engineer of the Bureau of Municipal Research in Cincinnati, later assistant city engineer, which gives details of cost of pavements and cost of maintenance and repair of pavements and outlines a method of keeping cost records and historical data concerning the pavements.

The annual report of the Department of Public Works of Cincinnati for 1912 contains some data on the cost of recent Cincinnati pavements and on the cost of repair and resurfacing of old pavements which are of much interest.

Fire Alarm for Small City

We are compelled to put in operation in our town some kind of a fire alarm. Does anybody make an electric fire whistle?

Do many towns of 2,000 use electric gongs? In your opinion what is the best for us to install? J., Mayor, ———, Ill.

The writer suggests the steam or the electric siren as distinctive in quality of sound and capable of making noise enough and of being used to give signals with.

If our readers have anything they think would be of interest we will publish brief articles describing the apparatus installed and stating the satisfaction given, if sent to us for the purpose.

How to Lay Concrete Walks

Have you back numbers giving instruction on concrete walks and on reinforced concrete, if so, what numbers?

D., ———, Neb.

The article on concrete pavement construction in vol. xlv, p. 8, will apply except perhaps as to surface finish to the construction of sidewalk. That on cracks in concrete on p. 54 will also be of direct interest, and that on the use of steel curb and gutter forms on p. 86 may have its application. The description of the Nelson street viaduct at Atlanta, Ga., on p. 145, and of the concrete pipe test on p. 146 are of interest regarding reinforced concrete. Other articles in vol. xlv are on methods which have developed successful concrete pavements, p. 152; steel vs. wooden sidewalk forms, p. 179; chimney withstood severe wind strain, p. 181; laying cement sidewalks, p. 196; concrete pavements in various cities, p. 186; concrete pavement costs, p. 243; the Capitol avenue bridge at Indianapolis, p. 268; concrete walls, p. 408.

There are many articles in earlier numbers, a list of some of which will be found in vol. xliv, p. 328.

The standard specifications of the American Concrete Institute for concrete sidewalks, latest edition, are as follows:

SIDEWALKS.

Materials.

1. Cement—The cement shall meet the requirements of the standard specifications for Portland cement of the American Society for Testing Materials and adopted by this association. (Standard No. 1.)

2. Fine Aggregate—Fine aggregate shall consist of sand, crushed stone or gravel screenings, graded from fine to coarse and passing when dry a screen having ¼-inch diameter holes; shall be preferably of silicious material, clean, coarse, free from dust, soft particles, loam, vegetable or other deleterious matter, and not more than 3 per cent. shall pass a sieve having 100 meshes per linear inch. Fine aggregate shall be of such quality that mortar composed of one part Portland cement and three parts fine aggregate by weight, when made into briquettes will show a tensile strength at least equal to the strength of 1:3 mortar of the same consistency made with the same cement and standard Ottawa sand. In no case shall fine aggregate containing frost or lumps of frozen material be used.

3. Coarse Aggregate—Coarse aggregate shall consist of inert materials such as crushed stone or gravel, graded in size, retained on a screen having ¼-inch diameter holes; shall be clean, hard and durable; free from dust, vegetable or other deleterious matter, and shall contain no soft, flat or elongated particles. In no case shall coarse aggregate containing frost or lumps of frozen material be used. The maximum size of coarse

aggregate shall be such as to pass a 1¼-inch ring.

4. Natural Mixed Aggregates—Natural mixed aggregates shall not be used as they come from the deposit, but shall be screened and remixed to agree with the proportions specified.

5. Sub-Base—Only clean, hard suitable material, not exceeding 4 inches in the largest dimensions, shall be used.

6. Water—Water shall be clean, free from oil, acid, alkali or vegetable matter.

7. Coloring—If artificial coloring material is required only mineral colors shall be used.

8. Reinforcing Metal—The reinforcing metal shall meet the requirements of the standard specifications for steel reinforcement adopted March 16, 1910, by the American Railway Engineering Association.

Sub-Grade.

9. Slope—The sub-grade shall have a slope toward the curb of not less than ½-inch per foot.

10. Depth*—(a) The sub-grade shall not be less than 11 inches below the finished surface of the walk.

(b) The sub-grade shall not be less than 5 inches below the finished surface of the walk.

11. Preparation—All soft and spongy places shall be removed and all depressions filled with suitable material which shall be thoroly compacted in layers not exceeding 6 inches in thickness.

12. Deep Fills—When a fill exceeding 1 foot in thickness is required to bring the work to grade it shall be made in a manner satisfactory to the engineer. The tops of all fills shall extend beyond the walk on each side at least 1 foot, and the sides shall have a slope not greater than 1 to 1½.

13. Drainage—When required, a suitable drainage system shall be installed and connected with sewers or other drains indicated by the engineer.

*Sub-Base.**

14—Width—Thickness—On the sub-grade shall be spread a suitable material as hereinbefore stated which shall be thoroly rolled or tamped to a surface at least 5 inches below the finished grade of the walk. On the fills the sub-base shall extend the full width of the fill and the sides shall have the same slope as the sides of the fill.

15. Wetting—While compacting the sub-base, the material shall be kept thoroly wet and shall be in that condition when the concrete is deposited.

Forms.

16. Materials—Forms shall be free from warp and of sufficient strength to resist springing out of shape.

17. Setting—The forms shall be well staked or otherwise held to the established lines and grades and their upper edges shall conform to the established grade of the walk.

18. Treatment—All wood forms shall be thoroly wetted and metal forms oiled before depositing any material against them. All mortar and dirt shall be removed from forms that have been previously used.

Construction.

19. Size of Slabs—The slabs or independently divided blocks when not reinforced shall have an area of not more than 36 square feet and shall not have any dimension greater than 6 feet. Larger slabs shall be reinforced as hereinafter specified.

20. Thickness of Walk—The thickness of the walk should not be less than 5 inches for residence districts, and not less than 6 inches for business districts.

21. Width and Location of Joints—A ½-inch expansion joint shall be provided at least once in every 50 feet.

22. Joint Filling—The expansion joint filler shall be a suitable elastic waterproof compound that will not become soft and run out in hot weather, nor hard and brittle and chip out in cold weather.

23. Protection of Edges—Unless protected by metal, the upper edges of the concrete shall be rounded to a radius of ½-inch.

Measuring and Mixing.

24. Measuring—The method of measuring the materials for the concrete, including water, shall be one which will insure separate uniform proportions at all times. A sack of Portland cement (94 pounds net) shall be considered 1 cubic foot.

25. Machine Mixing—When the conditions will permit, a machine mixer of the type that insures the uniform proportioning of the materials thruout the mass shall be used. The ingredients of the concrete or mortar shall be mixed to the desired consistency and the mixing shall continue until the cement is uniformly distributed and the mass is uniform in color and homogeneous.

27. Retempering, that is, remixing mortar or concrete that has partially hardened with additional water, will not be permitted.

TWO-COURSE WALKS.

Base.

28. Proportions—The concrete shall be mixed in the proportion by volume of 1 sack Portland cement, 2½ cubic feet fine

*Note.—When a sub-base is required, eliminate paragraph 10 (b). When a sub-base is not required, eliminate paragraphs 5 and 10 (a). Unless paragraph 10 (a) is eliminated 10 (b) will be void.

aggregate and 5 cubic feet coarse aggregate.

29. Consistency—The materials shall be mixed wet enough to produce a concrete of a consistency that will flush readily under slight tamping, but which can be handled without causing a separation of the coarse aggregate from the mortar.

30. Placing—After mixing, the concrete shall be handled rapidly and the successive batches deposited in a continuous operation completing individual sections. Under no circumstances shall concrete be used that has partially hardened. The forms shall be filled and the concrete struck off and tamped to a surface the thickness of the wearing course below the established grade of the walk. After the concrete has been thoroly tamped against the cross forms they shall be removed and the material for the adjoining slab deposited so as to preserve the joint. Workmen shall not be permitted to walk on the freshly laid concrete, and if sand or dust collects on the base it shall be carefully removed before the wearing course is applied.

31. Reinforcing—Slabs having an area of more than 36 square feet, or having any dimension greater than 6 feet, shall be reinforced with wire fabric or with plain or deformed bars. The cross sectional area of metal shall amount to at least 0.041 square inches per lineal foot. The reinforcing metal shall not cross joints and shall be lapped sufficiently to develop the strength of the metal.

Wearing Course.

32. Proportions—The mortar shall be mixed in the manner hereinbefore specified in the proportion of 1 sack Portland cement and not more than 2 cubic feet of fine aggregate.

33. Consistency—The mortar shall be of a consistency that will not require tamping, but which can be easily spread into position.

34. Thickness—The wearing course of walk in residence districts shall have a minimum thickness of ¾ of an inch, and in business districts a minimum thickness of 1 inch.

35. Placing—The wearing course shall be placed immediately after mixing and in no case shall more than 50 minutes elapse between the time the concrete for the base is mixed and the time the wearing course is placed.

36. Finishing—After the wearing course has been brought to the established grade it shall be worked with a wood float in a manner to thoroly compact it. When required the surface shall be troweled smooth, but excessive working with a steel trowel should be avoided. The slab markings shall be made in the wearing course directly over the joints in the base with a tool which will completely separate the wearing course of adjacent slabs. If excessive moisture occurs on the surface, it must be taken up with a rag or mop, and in no case shall dry cement or a mixture of dry cement and sand be used to absorb this moisture or to hasten the hardening. Unless protected by metal, the surface edges of all slabs shall be rounded to a radius of about ½-inch.

37. Coloring—If artificial coloring is used, it must be incorporated with the entire wearing course, and shall be mixed dry with the cement and aggregate until the mixture is of uniform color. In no case shall the amount of coloring used exceed 5 per cent. of the weight of the cement.

ONE-COURSE WALK.

The general requirements of the specifications covering two-course work will apply to one-course work with the following exceptions:

38. Proportions—The concrete shall be mixed in the proportion of 1 sack Portland cement to not more than 2 cubic feet of fine aggregate and 3 cubic feet of coarse aggregate passing a one-inch ring.

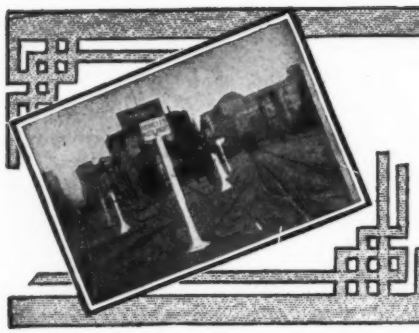
39. Placing and Finishing—The form shall be filled, the concrete struck off and the coarse particles forced back from the surface, and the work finished in the usual way.

40. Reinforcing—When a single course walk is to be reinforced, the metal shall be placed at the middle of the section. The minimum amount of metal shall be as specified in paragraph 31.

Protection.

41. Treatment—As soon as the concrete has hardened sufficiently to prevent being pitted, the surface of the walk shall be sprinkled with clean water and kept wet for at least 4 days. The walk shall not be opened to traffic until the engineer so directs.

42. Temperature Below 35 Degrees F.—If at any time during the progress of the work the temperature is, or in the opinion of the engineer will within 24 hours drop to 35 degrees Fahrenheit, the water and aggregate shall be heated and precautions taken to protect the work from freezing for at least 5 days. In no case shall concrete be deposited upon a frozen sub-grade or sub-base.



WORKERS IN THE FIELD

Commissioner Ward Proposes Chlorine Process to Purify Buffalo's Water

The Editor of MUNICIPAL ENGINEERING:

Sir—Buffalo pumps as high as 187,000,000 gallons in a day for 450,000 inhabitants, or over 400 gallons per capita, while many cities use only from 70 to 100 gallons per capita. With Buffalo's new pumping station completed, there will be a total capacity of 900 gallons per capita. How about Commissioner Ward's statements in reference to purifying this vast amount of water that the "chlorine necessary, annual cost is almost negligible," with fully 50,000,000 gallons wasted per day? It is also stated by Commissioner Ward that "The apparatus for mixing the chlorine at the intake is simple and will cost $10,000 or $15,000 only and the cost of the chlorine necessary to be used during the year is almost negligible."

On repaving Elk street 26 service pipes were found destroyed by electrolysis and only 2 services having houses, others vacant property. If same condition exists thruout city, should not a water waste survey reduce Buffalo's water consumption from 400 gallons by one-half or to less than 200 gallons per capita?

Why attempt to purify such a vast amount of waste water without cutting down consumption to a minimum by stopping leaks in mains, service pipes and taps?

FRANK C. PERKINS, Buffalo, N. Y.

Low Suction Lift More Economical for Turbine Pump.

The Editor of MUNICIPAL ENGINEERINGS

Sir—In your reply to the superintendent of water works who asked in the December number, p. 537, for the economical suction lift for a pump, it is stated that within the limits of 16 feet or 2 feet that the cost will be the same.

While this would apply for steam-driven pumps it would not apply to the turbine pump, as it has been the experience of several hydraulic engineers, and also my own, that when suction lift was greater than 12 feet the wear on the impellers of the turbine pumps became excessive, requiring in some cases the replacing of the impellers within a year from the installation of the same. The two cases I have in mind were pumps we installed at 15 feet above the water level and changed to 10 feet above water level. The impellers, which cost about $600.00 each, had not to be replaced each year as previously had been required with the heavier lift. In fact, these impellers mentioned are still in operation with very little deduction in efficiency at the end of two years.

ANDREW F. MCCALLUM,
City Engineer, Hamilton, Ont.

Patents on Vertical Circulation in Sewer Tanks

The Editor of MUNICIPAL ENGINEERING:

Sir—Answering the recent letter addressed by the Sterilization Company of Newark, N. J., to your paper, I regret that I am compelled to state that the positive statement made by them "that the so-called vertical circulation used by me at Springfield, Mo., is neither new nor original, but is an essential feature of the process set forth in the Travis and Ault patent, application for which was filed September 13, 1910," is at complete variance with the facts.

The patent referred to above is Patent No. 1,076,721, and was granted on the 28th of October, 1913. The process covered by the above patent can best be described by quoting directly from the specifications of the letters patent:

"The objects of this invention are to remove the impurities in suspension in sewage and other impure liquids; to secure the deposit and collection of such impurities rapidly and completely, in the order of their grossness and specific gravity; to provide for such deposit and collection a tank divided into compartments with sloping bottoms, and means

for controlling the flow from one compartment to another along said bottoms; to provide means for attracting from the sewage those impurities which exist in the form of colloids or solids in pseudo-solution; to provide means for removing the scum or solid matter which floats on the top of the liquid; to collect all of the solid matter in a common sludge pit, from whence it may be led by a single pipe, while the liquid effluent escapes through another channel; to enable the sludge to be drawn off from any compartment at any time without stopping the operation of the tank; to thus keep the tank in constant action in a uniform undisturbed condition; to utilize the pressure of liquid contained in the tank to force out the sludge from the bottoms of the compartments; and to obtain other advantages and results as may be brought out in the following description." * * *

"Briefly, the operation of our improved tank results in: (a) The separation of the grosser solid particles in the sewage in the well-known manner by means of a screen or the like, either fixed or movable, which is interposed in the flow of the sewage in such a way that the grosser solid particles are retained on or against the upstream surfaces of the screen whence they are from time to time removed by manual labor or mechanical means. (b) The separation of heavy solids chiefly of an inorganic nature, such as road detritus, by passing the sewage thru the first section of the tank. (c) The separation of the lighter solids of the fine particulate matter and of the solids in the colloid state in a succeeding section or sections of the tank. (d) The collection and removal of the several dissociated solids from the various sections or compartments of the tank."

The basic claim of this patent is as follows:

"1. The herein described process of purifying sewage or other liquid, consisting in supplying the liquid to a reservoir, allowing a portion of the liquid to escape directly from the upper part of the reservoir, conducting another portion of the liquid from the upper part of the reservoir downward nearly to the bottom of the reservoir and then upward thru the reservoir and out at its upper part, conducting the liquid escaping from the first said reservoir to a second reservoir, and repeating in said second reservoir divisional flow of the liquid in the same manner as thru the first reservoir, but in different proportions."

After a careful perusal of all of the specifications and claims of the letters patent the writer has failed to find any mention whatever of the vertical circulation which is claimed by the sterilization company as an essential feature of their patent.

To show further how completely at variance with the facts is the statement that the "so-called vertical circulation is neither new nor original with Mr. Potter as it is an essential feature of the Travis and Ault (Hampton tank) patent," which is No. 1,076,721, the writer begs to refer to Patent No. 1,081,329, covering the process of operating settling tanks and allowed the writer on the 1st of August, 1913, and issued by the department on the 16th of December.

This patent completely covers the vertical circulation referred to by the sterilization company, as can be seen from the basic claim which, quoting from the letters patent, is as follows:

"1. The process of settling sewage comprising admitting sewage to one side of a tank and drawing off water from the opposite side thereof, permitting the heavier matter to settle into a lower chamber thru an opening in the bottom of said tank, and causing an artificial circulation from said tank to said lower chamber."

How can the Sterilization Company explain the fact that a patent has been allowed the writer for artificial vertical circulation at the time when the Travis and Ault application for patent was before the Commissioner of Patents if it were true, as they claim, that such circulation forms an essential feature of the process claimed in the Travis and Ault patent?

Furthermore, the writer first saw a representative of this company a month after the designs for Springfield were completed. These designs were completed before the middle of February, 1912. The plans were then taken to Springfield by the writer in person for submission to the city authorities. The completion of the drafting of the finished plans took two weeks longer and they were forwarded to the writer (then in the Southwest) on March 1, 1912. These plans were finally approved by the municipal authorities at Springfield on March 15, and the work ordered advertised for April 4.

On March 1 the writer received a letter under date of February 23 from the Sterilization Company, admitting that they were informed by his office that the plans were based upon other designs than theirs, and requesting consideration of their method.

The writer returned to New York on March 19 after an absence of a month, and the following day a representative of the Sterilization Company called. For the first time the writer conferred with this company in reference to their system and its application at Springfield. They were advised that the Springfield designs would not be altered, but in response to their request were informed that if they desired to submit an alter-

nate bid based upon their own plans at the public letting on April 4 such bid would be given consideration if accompanied by guarantees of efficiency.

On the 26th of March a sketch plan was submitted by the Sterilization Company, showing what they proposed to offer, and on the 29th of March a letter was received from them giving a bill of material required for their plan. They found that it was impossible for them to submit a proposition on the sewage disposal plant as a whole, but requested the submission of their tank plans to general contractors.

ALEXANDER POTTER, New York.

Ideal Blue Print Equipment

The Editor of MUNICIPAL ENGINEERING:

Sir—We are pleased to give you a description of our blue-print department and trust same will be of suggestive value to municipal engineers contemplating similar installations.

The drawing rooms, mailing room and blue-print room are connected by a dumbwaiter, upon which all plans and mail are sent from floor to floor. A system of buzzers and speaking tubes enables the clerk on one floor to signal the clerk on any floor for which mail or blue prints are intended. It is not necessary at any time to carry any packages from one floor to another. The blue-print department was located in the basement because it was deemed advisable to have this room isolated from the other offices, as the blue-print department supplies blue prints for the master mechanic, operating department and mill order department, as well as for the drawing rooms.

It is not necessary to have the blue-print department in the same room or on the same floor with the drawing rooms, provided it is easily accessible to them. One objection to having a blue-print room in the drawing room is the tendency on the part of the draftsmen to wish to change drawings for revisions while they are being printed in the blue-print room.

In managing a blue-print room it is advisable to insist that all orders for prints be received from one source. By receiving the orders from one office it is always possible to dictate which prints are required first, and affords a better means of checking up the drawings which are sent to and returned from the blue-print room.

The blue-print department occupies two rooms, one 16 feet 3 inches by 19 feet, and the larger room 15 feet by 32 feet, the rooms being connected by a large door so that the two rooms are practically one as far as utility is concerned.

In the smaller room there is one continuous blue-print machine, a feeding table and a cabinet.

In the larger room are a blue-print machine, one feeding table, a supply cabinet, two trimming tables and a small table which serves as a desk for the chief operator.

The two feeding tables are about 2 feet wide by about 5 feet long and are placed directly in front of the machine. The operator stands between the feeding tables and the machine, and uses the tables for sorting out the tracings which are to be printed.

The two cutting tables are each about 4 feet wide by 6 feet long, and are used altogether for trimming and sorting blue prints. At the left end of the cutting tables are circular knives running in guides to cut the paper.

The two cabinets are used for storing blue-print paper, potash, extra globes, etc.

The receptacle for holding the blue-print paper is on a shelf which has perforated holes, and the door is provided with a screen opening. The object of the perforated holes and screen opening is to provide ventilation to keep the paper dry.

Another means for keeping the paper dry, which is sometimes used, is to place unslaked lime below the shelf which holds the blue-print paper.

The blue-print machines are of the Pease Peerless type, provided with electric heaters. The machines being continuous, paper is printed in rolls, and not in sheets.

When the machine is not in use it is necessary to keep a "dummy" in the machine, so that the paper to be printed can be attached to the "dummy" and started thru the rolls without the necessity of spending time in starting the paper thru the various rolls. The "dummy" is simply spoilt paper about 20 feet long. When it is desired to stop printing, the "dummy" is attached to the good blue-print paper and is run thru the machine until the "dummy" runs from the beginning of the machine where the tracings are fed to the winding-up rolls.

When printing the tracings are fed into the machine and by means of a roll and canvas band the tracing is moved in contact with a glass hump and while in motion the tracings are printed. The motion of the tracing is upwards, and while the tracings are moved frontwards toward the operator the paper itself which is printed travels over to the washing and drying apparatus.

The washing apparatus consists of a tube which is perforated with numerous small holes to squirt the water evenly over the surface of the paper. As the paper travels upwards it is treated to a

solution of potash, which is squirted on the paper likewise by means of a perforated tube. The paper is then washed again by water from another tube and then passes over the electric dryers.

As the paper comes down over the dryers it is received on a set of endless belts, which roll the paper up automatically. The paper can then be cut at the operator's convenience for trimming.

The width of the paper which can be handled in these machines varies from any size up to 42 inches wide.

While one machine might be sufficient to take care of the volume of work handled, it is advisable to have the two machines rather than one as a matter of convenience in printing rush orders without stopping the current work, and also to avoid delays in printing when one machine is being temporarily adjusted or repaired.

Often it is necessary to make prints on linen cloth; it is then a big convenience to have one machine print on linen and to permit the other machine to continue the printing on paper.

In some establishments an attachment is put on to the continuous machines for making direct blue line prints, but such prints are not required at this plant.

In making blue line prints a direct process is used, whereby the blue line prints are made directly from the tracing. This is a distinct improvement over the old method of making vandyke prints from the tracings and then reprinting the vandykes for blue line prints.

The machines are capable of printing 72 lineal inches of rapid printing paper per minute, but it is found advisable to use a speed of about 50 lineal inches per minute, as the operator cannot feed the tracings at a much more rapid speed.

As the different grades of paper print with different speeds and a clean tracing will print faster than an old tracing, the speed of the machine can easily be regulated by means of a rheostat, which is within reach of the operator.

On the basis of square feet each machine is capable of printing about 4,800 square feet of paper per working day of 8 hours. This is equivalent to 800 standard size prints, which are 24 by 36 inches outside dimensions.

Two operators are employed to handle the quantity of work, but if the volume of work is large enough to warrant keeping the two machines constantly busy at printing it would be necessary to have two trimmers in addition to the two operators. As it is with the amount of printing quoted in this paper, two operators are sufficient to take care of the work.

During the year 1912 832,825 square feet of paper was used, of which 811,614 square feet was actually printed, leaving a waste of 21,211 square feet, the percentage of waste being about 2½.

The largest amount of printing was made in May, when 85,365 square feet was printed, which is an average of 3,162 square feet per day. This average is less than the capacity of one machine, but the advantages in having two machines were explained before.

The largest output for one day was made on April 3, 1913, when 7,974 square feet of paper was printed.

When figuring the cost of maintenance it was announced that the life of a machine was 15 years. This would make the depreciation per year $70.00 for each machine. The cost of electricity for lighting, power and heating was assumed to be $300.00 per year for each machine. The total cost of supplies, maintenance and operation for the two machines for the year 1912 is as follows:

Cost of blue-print paper.....	$2,212.27
Salaries, two operators	1,486.65
Supplies, such as globes, fuses, coils, potash	130.96
Depreciation for two machines..	140.00
Lighting, power and heat.....	600.00

The writer is entirely satisfied with the machines used, as they have been giving excellent results with a low cost of operation and maintenance.

For emergency cases it is possible to send a tracing down to the blue-print room and to receive a blue print of that tracing within ten minutes.

We are buying our prepared blue-print paper in Chicago, but because of the inconvenience of getting the paper and keeping fresh paper on hand, it would be advisable to install a blue-print paper-coating machine.

A very good machine on the market is one manufactured by the C. F. Pease Company, Chicago, and called "The Pease Simplex." This machine occupies a floor space of 3 feet by 5 feet by 10 feet high, and has a capacity of turning out over 350 100-yard rolls per month.

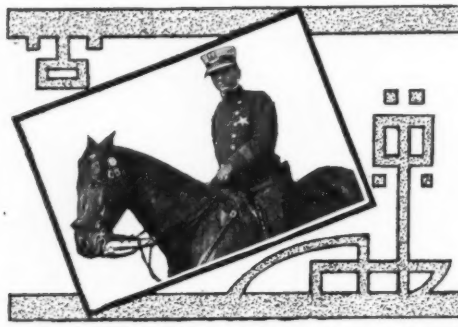
The paper stock runs into a chemical bath, where it is coated and then passes up into a dryer and ironing rolls, and is then rolled up automatically, ready for the blue-print machine.

The paper is measured automatically and a small bell can be set to ring when fifty or one hundred yards are coated.

After being set once, the machine requires very little attention and can be operated by the same operator who is printing at the blue-printing machine.

To further simplify the operation of this machine chemicals are prepared, mixed ready for use. These chemicals are prepared either in the dry form or in solution.

F. W. Dencer, Engineer,
American Bridge Company, Gary, Ind.



LEGAL DECISIONS

Decisions of the Higher Courts of Interests to Municipalities

Water pumping station must safeguard dangerous machinery.—The pumping station of a water company was an "establishment" within Factory Act, May 2, 1905 (P. L. 352), which provides for the guarding of dangerous machinery in establishments, though it was not what is commonly called an industrial establishment.—McNabb v. Clear Springs Water Co., (Pa.) 87 Atl. 55.

Municipal electric plant—power service—charge for extra expense.—A city, which undertakes to furnish electric light and power to the public, is subject to the same duties and obligations, and possesses the same rights and privileges as private persons or corporations doing the same class of service. Such a city is obliged to furnish power to all applicants who pay its proper and reasonable charges therefor. It cannot dictate to consumers what selection of appliances they shall make, as between those in common practical use. In this case relator found it necessary or advantageous in his business to use three-phase motors. Such motors are in common practical use. The city could not furnish current for three-phase motors without the use of transformers costing about $80. With such transformers it could do so. It refused to furnish power at all, unless relator would discard his three-phase motors and install one-phase motors, to which the city system was adapted. Held, the court should require it to do so. It does not follow that the city must bear the burden of the expense of such transformers. If a particular consumer desires service, which the city can supply only by the installation of transformers at an expense which is substantial, and which is not entailed in furnishing power to others, then the consumer who occasions such special expense should bear the burden thereof. The one essential is that, whatever the charge, it must apply to all persons similarly situated, to the end that there shall be no discrimination. As to the method of adjustment of such expense, whether by an installation charge, a rental, or an increased rate, the city has a large discretion. Its regulation, if fair and reasonable and free from discrimination, is binding on the applicant for service.—State ex rel W. J. Armstrong Co. v. City of Waseca et al., (Minn.) 142 N. W. 319.

Items to be considered by public utility commission in fixing purchase price of water works.—In a proceeding before the railway commission, brought by a municipal corporation under section 1797m—82, St. 1911, for the purpose of fixing the compensation to be paid for a water works plant operated by a public utility corporation under an indeterminate permit, the commission must award "just compensation," which means fair and reasonable value at the time possession of the property is actually taken. Tho, under the provisions of the law, payment may be deferred in the discretion of the commission for a reasonable time after possession is taken, legal interest must in that case be provided for in the order from that time until the payment is made, in order to constitute "just compensation." The order in such a case cannot rightly require the municipality to pay, in addition to such just compensation, the costs of an action which may be thereafter brought by the utility corporation against the commission to alter or amend the order, whether such action be successful or not. No allowance can be rightly made in such order for the value of the indeterminate permit, for the reason that such permit has ceased to exist. If the commission, in reaching its conclusion as to "just compensation," takes into consideration, in connection with other data bearing thereon, an estimate of the present cost of reproduction of the plant, such estimate can not rightly include the cost of work which may be legally assessed, and in the exercise of good business judgment ought to be assessed, against the consumer; e. g., in the present case the cost of trenching, and of breaking up and relaying permanent pavements for the laying of new service pipes from the main to the corporation cock in the curb. "Going value" is that element of value which comes from

the fact that the business is a going concern. It is not franchise value, nor the value of good will. It is difficult to separate or measure in dollars, because the value of the plant and business is inherently indivisible, and this latter value is obtained by taking a comprehensive view of each and all of the elements of property, tangible and intangible, including property rights, and considering them as inseparable parts of a harmonious entity, and exercising the judgment as to the value of that entity. In this way the "going value" goes into the final result.—Appleton Water Works Co. v. Railroad Commission of Wisconsin, 142 N. W. 476.

Relations of municipal light plant with competing private plant—right to furnish power and water.—A city or village has the power, under the provisions of section 8704 et seq., Ann St. 1911, to construct and operate a municipal electric light system for the purpose of furnishing lights to the city and the inhabitants thereof. Under our statutes, the city may use the engines and power of an electric light plant to pump water for the use of the city and its inhabitants. In constructing such a system, due regard must be given to the rights of the owners of the present system. The municipal system should be so constructed as not to unnecessarily interfere with the property rights of the owners of the present plant, and in case of necessary interference the city will be liable for the injury sustained. The city having denied that it will construct its light plant in such a manner as to interfere with the property rights of the owners of the present system, and introduced proof to sustain that allegation, held that plaintiffs are not entitled to enjoin the construction of the municipal plant before there is actual or threatened interference.—Bell et al. v. David City et al., (Neb.) 142 N. W., 523.

Village not liable for defective water trench outside of improved roadway.—An unpaved street in a country village had a roadway thirty or more feet wide outside of which a water main had been recently laid. The earth had been returned to the trench by hand, it not appearing whether or not it had been tamped. Plaintiff, who saw the situation, attempted to cross the trench, not at a street intersection, in going from a coal yard adjoining the street to the street, and was injured when the wheel of his wagon dropped into the soft earth throwing him out. Held, that the village was not liable for his injuries.—Patow v. Village of Oakwood, (Mich.) 142 N. W. 575.

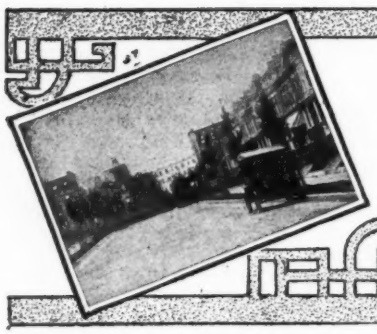
Water service cannot be refused pending judgment as to justice of increased rate.—Where a water company, after the expiration of a contract with the city whereby it furnished water to the citizens at certain rates, notified the consumers that it would sever its water connections in the future unless they signed an agreement to pay an increase of one-third in the rates, a temporary injunction can be issued to restrain the severance of the connections pending the determination as to the justice of the increase. Under Code Civ. Proc., section 448, providing that where the question is one of general interest or the persons who might be made parties are very numerous, one or more may sue for the benefit of all, a water consumer may sue as plaintiff on behalf of all others similarly situated to restrain a water company from severing its connections with the consumers in a city after the termination of its contract with the city, unless they would agree to an increase in the rates.—Whitmore v. New York Interurban Water Co., 142 N. Y. Supp. 1098.

Sidewalk Assessments per Front Foot Average.—The statute provides, "That the owners of real estate so abutting shall pay the entire cost of such work, on the basis of the respective frontage of the property on the sidewalk or curbing to be paved or improved." Held, that the entire cost of construction on each street should have been apportioned on the basis of frontage, and that the assessment against the defendant of the entire cost of the work done in front of his particular lots was illegal; but that the failure to properly apportion the cost of the work does not preclude the plaintiff from hereafter making a proper assessment. Town of Minden (La.) v. Glass, 61 So. 874.

Value of Water Power

In the case of Kraft v. Hanover & McSherrystown Water Co., in the Supreme Court of Pennsylvania, reported in 88 Atl. Rep., p. 909, the plaintiff sues for damages because the water company, by pumping water from the stream, reduced the amount of power available at his mill, some distance below the water works intake, and had done so for about six years. The evidence showed that the water company pumped not more than 400 gallons a minute from the stream, that this would amount to 0.8 of a horse power if delivered at the mill, and that the cost of a horse power per year was estimated at $90. It was also shown that the stream was so low at times prior to its use by the water company that the mill owner was obliged to install steam power for part of the time.

Nevertheless, the jury gave the mill owner a verdict for $2,550, and it was reduced by the court to $1,922.49, the verdict of the jury being deemed excessive by him.



ROADS AND PAVEMENTS

The Relative Economy of Constructing Bituminous Pavements by Penetration Methods

By George C. Warren, President of Warren Brothers Company, before the American Association for the Advancement of Science.

In his treatment of this subject which has been selected by the Society, it is but fair for the writer to state that he is commercially interested in bitulithic pavement and Warrenite highway construction, and has carefully avoided all participation in the development of any inferior form of construction. Notwithstanding this affiliation he has endeavored to submit an unprejudiced discussion of the subject. He proposes to consider the matter of "economy" in its broadest sense, i. e. general efficiency rather than initial cost of construction, which cost of construction is in reality only one factor, and the writer believes one of the least important, although quite generally regarded as the all important factor of economy.

Taking this broad view of economy, the writer proposes to adhere strictly to the subject and not becloud the issue by referring to the makeshift forms of construction, which are so frequently miscalled "bituminous concrete (mixed method)" but which are not concrete at all; either because:

(a) On the one hand they consist of mineral aggregate of nearly uniform size, merely coated with bitumen, containing about forty per cent. of voids, thru many of which a good sized worm could crawl, and thru which water can pass as freely as thru a grape basket after the "seal coat" of original thickness, less than one-fourth (¼) inch, has been broken or worn off by traffic; or

(b- On the other hand they consist of mortar (mixture of sand and bitumen), with the addition of a little fine crushed stone (just "enough to swear by"), like currants in a fruit cake.

Nor does he propose to discuss the makeshift construction, which consists of spreading oil or other bituminous material over concrete or old macadam road surfaces, because this is not really a penetration method, as the bitumen does not in practice penetrate the roadway, but merely produces a thin temporary surface coating consisting of the bitumen and the sand or screenings spread over same.

Keeping constantly in mind this broad view of the term economy he proposes to discuss only:

(a) True bituminous concrete and
(b) bituminous macadam as defined by the American Society of Municipal Improvements at its 1911 Convention at Grand Rapids, as follows:

BITUMINOUS PAVEMENT DEFINITION.

"*Bituminous Concrete* is a pavement consisting of a combination of broken stone and sand, or fine mineral matter, cemented together with a bituminous cement, and which has all its ingredients mechanically mixed before being laid. To be termed a bituminous concrete it must partake of the well-known characteristics of concrete, that is, there must be stone enough in its composition to form an important part thereof and add to its strength and durability; also there must be enough of the mortar constituent, that is, the sand and bituminous cement, to properly support and bond together the largest particles. It is normally a one-layer pavement, all parts of it having equal stability, due both to the structure of stone and the bond of the bituminous cement, and depending on the base for vertical support only. It may or may not be finished with a skim coat and top dressing of sand or stone chips. It is adapted to be laid on either a concrete or macadam base which may or may not have a light coat of bitumen to increase the adhesion."

"In the paving mixture, gravel may wholly or in part be substituted for

PORTION *of Huntington Avenue, Boston, laid with broken stone treated with asphaltic materials applied by the penetration method, after four years of wear.*

crushed stone, and fine crushed stone for sand. Mineral dust also may be added to increase the density and stability of the mixture."

"*Bituminous Macadam* is a pavement consisting principally of crushed stone, retains its integrity of structure mainly by the mutual support of the various particles of stone, aided by the slight bonding value of the fine mineral matter in its composition, and protected from surface disturbances by an upper bonding of bituminous material. It is a one-layer pavement and there is no definite distinction to be made between the wearing surface and the base, as in their nature they must be knit together in one structure. Practically all the horizontal stability as well as vertical support is from the macadam base. * * *"

As it is manifestly impossible to express a true comparison of the economy of these two types of construction in dollars and cents, the writer will endeavor to show the relative satisfaction which has been given the public by several instances where both types have been in use on the same street for several years.

In a paper prepared by the writer for the International Road Congress held in Brussels in July, 1910, on the subject of "Bituminous Roads—Mixed and Poured," he referred to a then recently constructed "bituminous macadam penetration meth od" road then one year old and constructed with most careful consideration of the details and most approved methods of construction on Huntington Ave., Boston, one section using bituminous cement prepared from coal tar and the other from asphalt.

A series of eighteen photographs accompanied that paper, showing, that notwithstanding the unusual care practiced in the construction, the unequal distribution of the bitumen was such that the surface of the road was badly marked, rutted, and shoved, in many places having a surplus of bituminous material, and in many other places pitted and ravelling where insufficient bitumen was distributed, or where it had penetrated insufficiently into the voids between the particles of stone.

Now, after four years' use and very considerable repairs each year, the bituminous cement prepared from coal tar has practically all disappeared, and the macadam, which is also badly worn, is carrying the traffic. In small portions of the surface, where a surplus of bituminous material was used, it is still in evidence and its condition fairly represented by the photographs taken in March, 1913.

The section in which asphalt cement was used, is, after four years' use, in better condition than the coal tar cement section referred to above, because, in the asphalt section the asphalt for the most part is still in evidence, but the road surface is in a most deplorably unsatisfactory condition, as shown by the accompanying photograph.

On the same side of Huntington Ave.,

but two miles nearer the center of the city, and consequently carrying more than double the volume of traffic of the "penetration method" construction above referred to, is a "bituminous concrete mixed method" pavement laid in 1905, which has stood the traffic of eight years and is illustrated by the second photograph shown herewith.

The relative economy of these two stretches of pavement is about as follows:

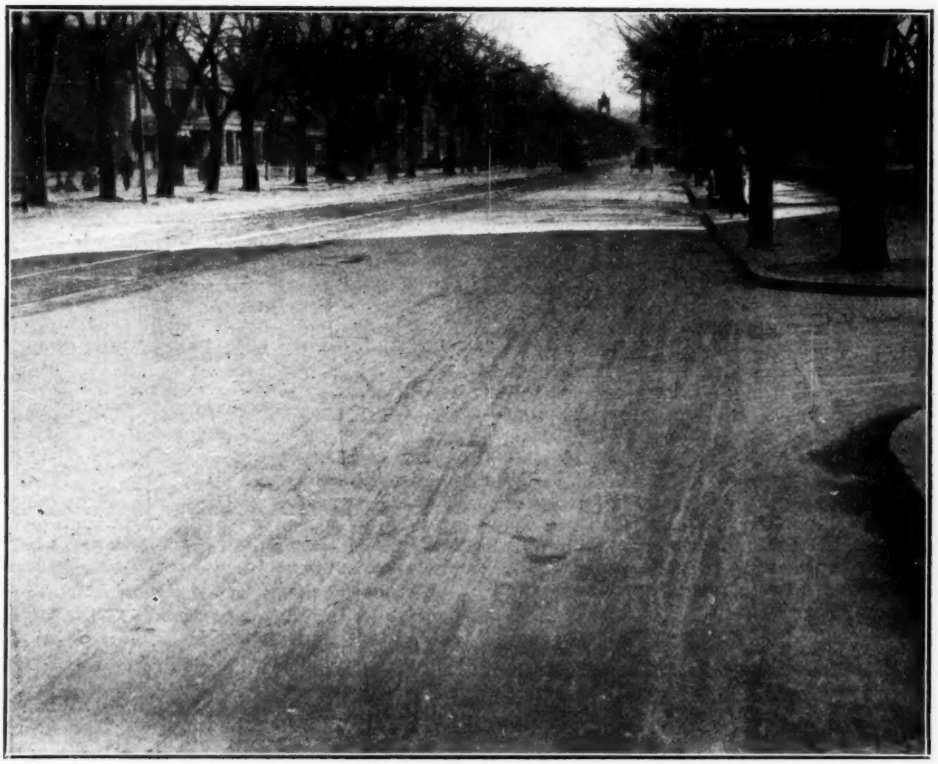
First—Length of time street was closed to traffic during initial construction, about equal for the two types.

Second—General appearance of street surface at time construction was completed, about equal.

Third—General appearance during the first warm weather in the spring following construction: Bituminous concrete presented uniform, hard, gritty surface, affording easy traction, and good footing for horses. Penetration method, where insufficient amount of bitumen had been used, was already ravelling in spots, but where excess of bitumen had been used, surface was badly shoved in spots, and bleeding to such an extent that the area which had been laid with asphalt cement was given a coat of crushed screenings, which soon ground up and made the street exceedingly dusty for some weeks, and also made traction so heavy during warm weather, that horses approaching this stretch at a trot would break into a walk before traversing one-half its length.

Fourth—Interruption to traffic while making repairs: Bituminous concrete, has stood for eight years without any such interruption. Penetration method, has during the four years of its life, been repaired in spots many times, with traffic naturally impeded, even tho not entirely blocked by the repair gang.

HUNTINGTON AVENUE, *Boston. A section much nearer the city than that shown in the preceding photograph, laid with bituminous concrete. Note the excellent condition after eight years of use.*



MASSACHUSETTS AVENUE, *Cambridge, Mass., at Arlington street, looking toward Harvard Square, laid with bituminous concrete in* 1909 *and in excellent condition December* 3, 1913, *the date of this photograph.*

Fifth—Initial cost of the stretch laid by the penetration method is not known by the writer, but was probably about two-thirds that of the bituminous concrete.

Summarizing the above shows that these two types of construction have given the city service as follows:

Bituminous Concrete: A wearing surface perfectly satisfactory for all classes of traffic for eight years. The volume of traffic being moderately heavy at time of construction, and steadily increasing since that time.

Penetration Method: Gave satisfactory wearing surface during the few winter months immediately succeeding its construction, but has never been satisfactory since that time.

This construction was cheap in first cost, but its present condition well illustrates the fact which should be axiomatic, but is not generally so regarded, that first cost is but one and that a small factor in the question of economy. Altho the street referred to does not carry more than moderate or medium traffic, it is a most inportant street. Opposite the above section referred to, laid with "bituminous pavement by penetration method," there are millions of dollars in public and private property, including Boston's pride, the new Museum of Fine Arts, the Boston Opera House and the Harvard Medical School buildings and grounds. The unsightly and uncleanly condition of the roadway is the one blot on the landscape and a form of pavement construction, which would have avoided that blot, would have been an economy even if the first cost had been five times as great and could not have been secured at lower cost.

As an example of "bituminous concrete" roadway surface measuring up to the standard of the A. S. M. I. definition above quoted, Dartmouth St., Boston, opposite the Vendome Hotel, extending from Newbury St. to Beacon St. and crossing the world-famous Commonwealth Ave., is cited. This pavement was constructed in 1903.

After the Dartmouth St. pavement had been in use for eight years, a strip thru the center one-third the width of street was removed in connection with the building of a sewer, which removal de-

veloped that the wear in eight years had been inappreciable.

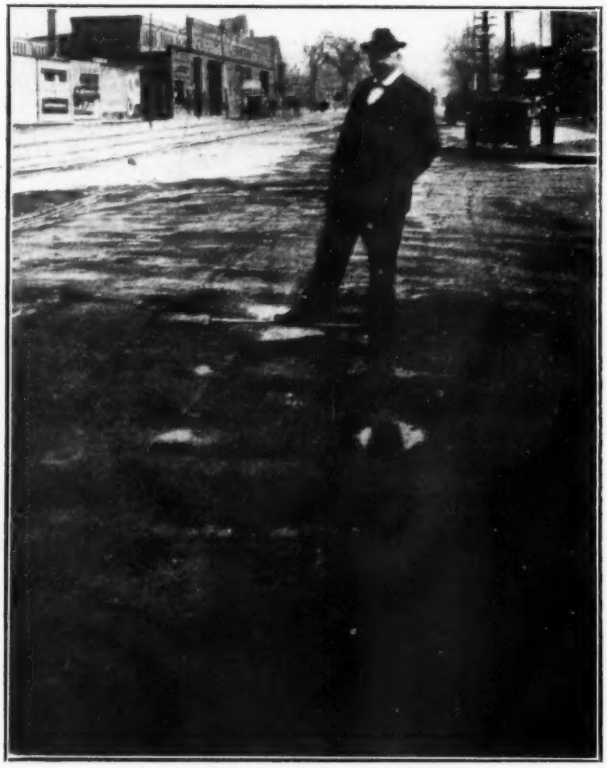
Boylston St., Boston, from Dartmouth St. to Hereford St., laid with bituminous concrete in 1904, sustained the heavy traffic of that business thorofare for eight years until in 1912 it was removed, its removal being necessitated by the construction of a new railroad subway, and this street was relaid with the same material in 1913.

Another example of comparative results of "bituminous concrete—mixed method," and "bituminous macadam—penetration method" on the same street, is afforded by Massachusetts Ave., Cambridge, Mass., where, like Huntington Ave., Boston, the "bituminous concrete" is nearer the center of the City, and therefore subjected to the greater traffic. The portion of Massachusetts Ave. from a point near the B. & M. R. R. Bridge, North Cambridge, to the entrance to the subway opposite Harvard College, was laid with bituminous concrete in several sections from 1909 to 1912, and is illustrated by the accompanying photograph of the oldest portion.

The east side of Massachusetts Ave., Cambridge, from Blake St. about 500 feet north of the B. & M. R. R. Bridge to Alewife Brook at the city line, a distance of about one mile, was laid with "bituminous macadam—penetration method" in 1908. This has been entirely resurfaced three times during the intervening 5 years and is now in bad condition, as shown by the fourth of the accompanying photographs.

In substantiation of the assertion of the writer at the outset of this paper that the spreading of oil or bituminous material on a concrete road is but a makeshift construction, he incidentally calls attention to the west side of Massachusetts Ave., Cambridge, from the B. & M. R. R. bridge in North Cambridge to the city line at Alewife Brook, which was laid with portland cement concrete pavement in September, 1907, has required heavy repairs every year since, and in 1912, after repairing the holes in the concrete, was coated with liquid bituminous material and sand, of which it received a second application in 1913

As confirmation of the truth of the corresponding statement made at the outset of this paper, that so-called and miscalled "asphaltic concrete mixture method" (open mixture) is not worthy of discussion under the title of this paper, the following illustration is given of a section of Commonwealth Ave., Boston, near the Brookline line and about five miles from the State House, in which photograph are shown contiguous sections of "open mixture" and "bituminous concrete," both laid in September, 1912.



MASSACHUSETTS AVENUE, *Cambridge, Mass. Section laid in* 1908 *with bituminous macadam by penetration method. Resurfaced three times and now in bad condition, as shown by photograph.*

True economy in road or pavement construction cannot be measured by dollars and cents of cost, however frequently the effort may be made to so measure it. Consequently in considering the subject the writer is not making any effort to discuss economy from that point of view. The real measures of economy are, general suitability for the purpose intended; durability; utility; wear and tear on vehicles; sanitation; cleanliness; sightliness; and last and least of all, first cost. These are matters which must or should receive careful consideration in each particular case.

February, 1914

COMMONWEALTH AVENUE, *Boston, Mass., showing contiguous sections of bituminous concrete and bituminous macadam laid in* 1912 *and their condition after about a year of use.*

Doubtless there are some places where the traffic is so exceedingly light that the penetration method will produce a surface which will answer all practical purposes, and in such cases the less cost of this type would naturally make it the more economical in the broad sense in which the writer has endeavored to view the subject. However, it is the writer's firm belief that such cases are exceedingly rare, and that in judging any one particular case, it is exceedingly dangerous policy to assume that this type of construction will give any better satisfaction to the general public than the cases cited in this paper; and when forming such a judgment, it must be remembered that the traffic on all streets and roads is increasing by leaps and bounds, and at far greater rate than it increased in former years, therefore the tendency is always to underestimate the amount of traffic a street or road will be called upon to resist.

In conclusion, we must not be unmindful of the fact that in the construction of any type of roadway surface, full consideration must be given to careful, scientific, accurate details of construction and to the further fact that "the best is none too good" applies with special force to road construction.

From the examples selected for illustration which have come to the writer's immediate notice, he has attempted to select examples which have had the benefit of most careful construction and supervision, subjected to similar traffic conditions, and he believes that the examples illustrated are typical of the several types of roadway surface referred to, and subjected to moderate normal traffic conditions.

Report on Concrete Roads in Wayne County, Michigan

Road commissioners and engineers who are struggling with the problem of building roads that will stand up under a large volume of automobile and motor truck traffic, mixed with teaming, will find much information of interest and value in the seventh annual report of the Board of County Road Commissioners of Wayne county, Michigan, recently issued.

This report covers the year ended September 30 last, and is fully illustrated with engravings from excellent photographs showing the method followed in making the concrete roads for which Wayne county is becoming famous, as well as the appearance of the main county roads leading out of Detroit before and after improvement. It embraces a tabulated record of all kinds of traffic passing over the roads and of all cracks and holes that have appeared in the concrete surfaces. Itemized costs of construction of different roads are given, and there are reports of tests of strength of different samples of concrete to show the effect of the amount of mixing; also a report on an experiment in the elimination of expansion joints.

The report points out that the only serious objection that so far has been advanced against concrete roads is the development of cracks, and the commission-

ers do not consider this is a material objection, as the cracks can be repaired readily with a little hot tar, and the formation of cracks can be minimized by careful workmanship. A careful count was made of all cracks that had occurred in more than forty-five miles of roads put down before January, 1913, and it was found that there were 500 transverse cracks and 1,156 longitudinal cracks in 9,121 25-foot sections of concrete laid during 1909, 1910, 1911 and 1912. Thus, there was one crack for every five and one-half sections, or in an area of about 1,650 square feet.

The traffic census taken on the roads leading out of Detroit covers seven days in August and seven days in September, twenty-four hours a day, and shows an average passing any one point in the twenty-four hours was as follows:

Single-horse, 195; team, 207; automobile runabout, 137; touring car, 512; motor truck, 42; motorcycle, 59.

The showing made by motor trucks introduces a complication in road building and maintenance. This is certain to increase at a rapid rate for both city and country, and necessitates a better foundation and wearing surface than is being constructed in many localities.

The Construction of Creosoted Wood Block Pavements

By R. S. Manley,
President Creosoted Wood Block Paving Co., New Orleans, La.

A CREOSOTED wood block pavement should show no evidences of wear for many years if the proper materials are used, and if they are assembled in the proper way.

The correct depth of base, or foundation, varies with the soil conditions, but the materials forming this concrete foundation and the methods of mixing are in such common use as to be standard and easily secured.

We are interested principally in the construction placed on top of the concrete. The principal causes of defects of more or less serious nature are (1) irregular or uneven surface due (a) to careless laying, (b) to shifting of sand cushion, (c) breaking or settling of concrete. (2) Expansion difficulties due to the entrance of water into the blocks either by way of the joints or from below.

The first (irregular or uneven surface) is death to any paving material because a depression in the surface holds water and repeated churnings of wagon wheels in the depression are bound to cause an enlargement and deepening of the depression.

To avoid (a) the concrete should be mixed quite wet and finished smoothly with a flat wooden spreader, which gives a surface practically as even and uniform as could be obtained by templet. On this should be spread from one-half to one inch of clean sand, making the sand cushion conform to the contour of the finished street. On this place the blocks quite closely together, roll thoroughly until a perfect surface with no inequalities has been obtained and until the blocks are firmly in place. It will require a great deal of rolling to accomplish this, but the end justifies the means. After this fill all joints two-thirds full of hot bituminous filler of such melting point as is suited to climatic conditions, and spread a thin coating of sand thereon. The use of bituminous filler is, in my estimation, the most important of all. It converts the street into an effective watershed which, without absorbing any of the water, directs it into storm sewers or other drainage paths. Should any water remain on the surface the wind and the sun, both good evaporating agencies, will rapidly dissipate it.

Now, you have an absolutely even surface, water-proofed and converted into a watershed. This surface cannot be worn by traffic, because the pressure of wheels is even and regular and there is no dropping or jolting of wheels entering and leaving low spots. The blocks are laid tightly together, so that there is no wearing at the joints. There can be no change in the sand cushion as long as the surface remains intact, a solid sheet, in fact, of wood block cemented together by the filler, and consequently the difficulty of shifting cushion is avoided. It is assumed that the concrete is sufficiently strong so that it will not break or settle. In planning the depth, any error should be on the side of too great, rather than too little depth.

Expansion difficulties are eliminated by the use of bituminous filler, for there can be no expansion without absorption of water, and no absorption of water when all rainfall is conducted quickly to drainage sewers. In addition to this it must be remembered that with the bituminous filler each block is surrounded by an individual expansion joint.

The other way of constructing wood block surface which is sometimes recommended is to provide a mixed sand and cement cushion and sand-filled joints or interstices. The sand and cement cushion does not give the opportunity for absolutely smooth surface that the sand cushion gives and is considerably more costly. The sand filler in the joints allows moisture to be absorbed in the pavement, and ultimately this moisture gets into the blocks and trouble ensues. It is only on extremely heavy traffic streets that sand can be used as a filler without expecting some expansion difficulties

sooner or later. The proof of the pudding is in the eating and the proof of theories of wood block construction lies in the actual occurrences on the street.

It can be stated without fear of successful contradiction that every sand-filled pavement in the South has at one time or other given trouble from uncompensated expansion, and with equal confidence it can be stated that not one bituminous-filled pavement has given trouble from this cause.

Now there have been objections put forward to the bituminous filler because of the belief that it would produce a sticky surface, disagreeable in warm weather; but if the proper filler is secured and it is correctly applied, there can be no such objection. The suitable filler has a consistency of rubber and can be taken in the fingers, bent and twisted without soiling the fingers. In applying this filler a spreader with squeegee attachment places the filler in the joints where it is needed and not on the surface of the blocks where it is not needed.

It is proper also to use less creosote oil per cubic foot of timber when bituminous filler is used, for the primary function of the creosote oil in this case is to preserve against decay instead of trying to make the creosote oil fill the double role of preservative and absolute waterproofer. No one familiar with preservative methods and history will question the efficacy of sixteen pounds of creosote oil per cubic foot in preserving against decay for an indefinite period. We, therefore, see that bituminous filler can be used carefully and without inconvenience because of stickiness.

To sum up, therefore, provide adequate smooth concrete foundation, use enough sand to cover any inequalities in the concrete or depth of blocks (except in railway areas and on grades when use sand and cement mixed), lay blocks tightly, roll until smooth, fill joints with bituminous filler, spread coating of sand, and turn on traffic.

Economical Plant for Handling Gravel for Road Building.

The good roads movement has been well established in the State of Indiana. In order to facilitate this movement Mr. J. Harris Reed, township trustee at Waterloo, Ind., succeeded in having a law passed which gives the township trustees authority to purchase machinery for excavating material for road building.

After this law had been signed by the Governor a number of the township trustees at once availed themselves of the opportunity and advertised for bids on excavators for excavating gravel from dry and wet pits.

Mr. Reed was practically one of the first trustees in Indiana to install such an excavator. He purchased a Shearer & Mayer drag line cableway excavator. This excavator was put in operation the latter part of July and has been excavating sand and gravel from several different pits and under various conditions.

In his investigation of machinery Mr. Reed based his selection on equipment having the greatest efficiency under various conditions. The excavator as installed consists of a ¾-cubic yard capacity excavator bucket suspended from a carriage which travels up and down an inclined track cable attached to a tension

FIG. 1. *Drag-line bucket excavator filled and emerging from wet gravel pit.*

mechanism at the top of a mast at one end and to a ground anchorage at the other end. In operating the excavator the track cable is raised and lowered by means of a line from the hoist to the tension mechanism.

To bring the bucket to a digging position the operator allows the bucket to travel down the incline and by lowering the track cable brings the bucket in contact with the material. The bucket is then filled by dragging it thru the material by means of a load line attached to the front and running thru a guide block at the top of the mast and down to the hoist. When the bucket is filled the track cable is pulled taut, which raises the load above the material, as shown in Fig. 1.

The load is then conveyed up the in-

cline at full speed until a traveler block riding ahead of the carriage strikes an adjustable stop button on the track cable, which automatically reduces the speed of the carriage and at the same time causes the bucket to dump its load. All shock of the impact between the traveler block and stop button is absorbed in the chain mountings of bucket and carriage. This dumping arrangement allows the operator to become highly efficient, as no time is lost at the dumping point. To return the bucket to the digging point the operator releases the friction of the hoist and the carriage travels down the incline by gravity.

Since its installation this machine has done the work of stripping loam and clay overburden and excavating sand and gravel from the underlying beds in wet and dry pits. The nature of the material has varied from sticky clay and loose sand to hard-packed gravel and boulders.

Fig. 1 shows the loaded bucket emerging from a wet gravel pit. Fig. 2 shows the bucket in transit from pit to dump.

The plant was furnished by and installed under the supervision of Sauerman Bros., Monadnock block, Chicago, engineers and dealers in cableway machinery.

Greater Winnipeg Water District

Tenders are being called for February 11 for the following preliminary work on the Greater Winnipeg water supply project: Railway track grading and track laying, including right-of-way clearing; 60-lb. rails and track sundries; five residences and office buildings; 85-mile telephone line; certain core drilling in the rock near the proposed Red river crossing of the water supply.

The work to date has engaged the services of about 100 men, including engineers and their assistant labor. They have cross-sectioned and explored the country between Winnipeg and Indian bay, Manitoba, and trial lines are being run for the aqueduct. Considerable success is being attained in efforts to discover a uniform continuous down grade from Shoal Lake to Winnipeg, so that a gravity supply at minimum cost may be available in Winnipeg. The remainder of the winter will be required for completing studies of this problem.

A large staff has also been engaged in the office in the collating of field notes, in making the preliminary designs. Good progress can be reported in drafting of specifications for the preliminary stages.

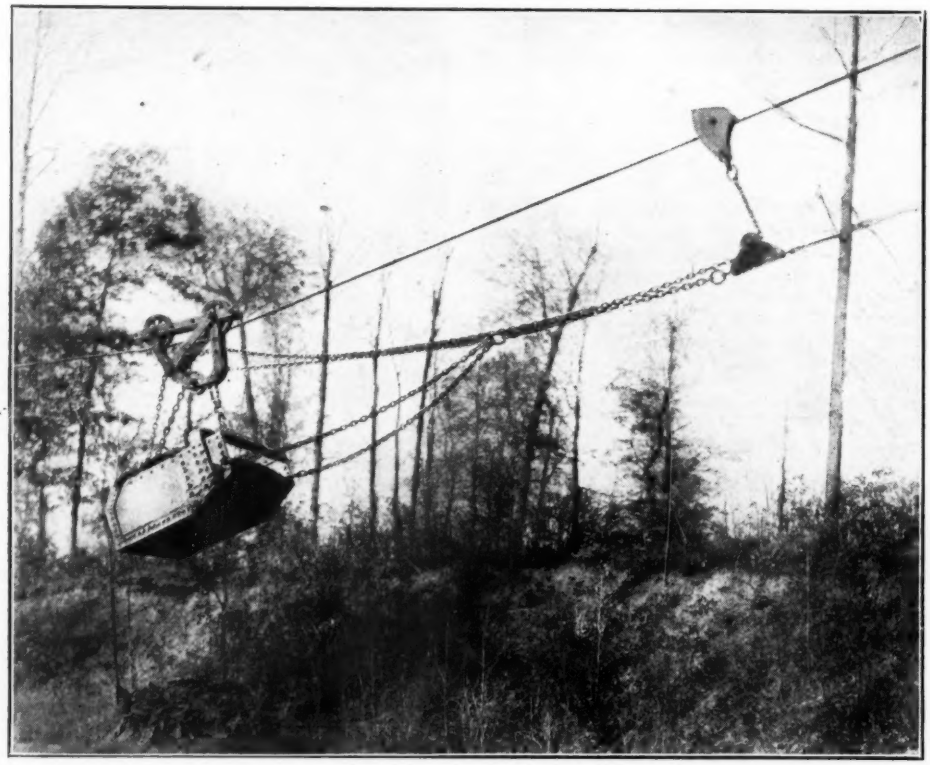
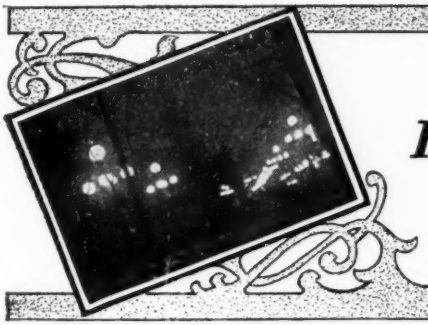


FIG. 2. *Drag-line excavator bucket on its way from gravel pit to dump, side view.*



FIRE AND WATER

Cost of Los Angeles Water Supply

That the Los Angeles aqueduct is completed none too soon is shown by the last annual report of the department, which shows the rapid increase in territory served by the city plant and the difficulties which the municipalities taken in have had in supplying themselves.

The report gives a detailed statement of the cost of the great aqueduct, showing all the items of the cost as follows:

The first issue of Aqueduct bonds, expended in preliminary surveys, purchase of lands in and above Owens valley, water rights, rights of way, etc.	$1,500,000.00
The second issue, $23,000,000, expended in construction of aqueduct, minus $61,000 on hand and $700,000 of salvage	22,239,000.00
Aqueduct liabilities unpaid as hereinbefore set forth.	490,000.00
	$24,229,000.00
Paid out of Water Revenue Fund as follows:	
One-half of Mr. Mulholland's salary during period of construction of aqueduct..	$ 52,500.00
Purchase price of San Fernanda Reservoir site.....	126,000.00
Cost of San Fernando dam to date	319,785.73
Interest on Aqueduct bonds paid by tax moneys, up to May 12, 1913	3,110,057.93
Making total cost of the aqueduct	$27,837,343.66

The original estimates, represented by the $24,500,000, have been exceeded some 3 1-3 million dollars, including the payments of interest. Work not included in those original estimates includes about a million dollars spent in additional cover over the aqueduct, and the San Fernando reservoir work in the table, in all some $1,500,000.

It will be noted that the funds expended have come from three sources: the two issues of bonds, which will a little more than pay the bills, including the extras, on the aqueduct proper; the water revenue fund, which will pay the San Fernando reservoir bills, and the taxes levied to pay the interest on the aqueduct bonds.

There has been considerable complaint of the charge made in recent years for extending new mains of 80 cents per front foot, but it is fully justified by the financial principles which should govern. It is found to be too low to meet the cost of the extensions. A new plan is proposed whereby the water rates will be lowered to those who pay the front foot assessments in a lump sum, or they will be kept at the present rate for those who cannot or prefer not to pay the assessment at once, thus enabling them to extend the payment over a series of months or years.

The board recommends that the rates for those entitled to the reduction be made 50 cents a month minimum, allowing 500 cubic feet to use, and 7 cents a hundred with a minimum of 75 cents if the consumption is more than 500 cubic feet a month—rather a peculiar combination.

Sinking of a Steel Well at Galesburg, Ill.

The question of an adequate water supply for the city of Galesburg, Ill., up to a short time ago, has been a vexatious one. Tho a city of 25,000 inhabitants, it has been dependent for its supply upon about five small wells 8 inches in diameter and 80 feet deep. The strata thru which these wells are sunk consist of about 14 feet of clay on top, followed by 55 feet of a very fine sand, then 10 feet of a coarse torpedo sand, with some gravel, 1 foot of blue rock and slate, with solid blue clay at 80 feet. The bottom 20 feet of the casing is perforated, allowing the water to pass thru, it being lifted by a small impeller operated by a motor

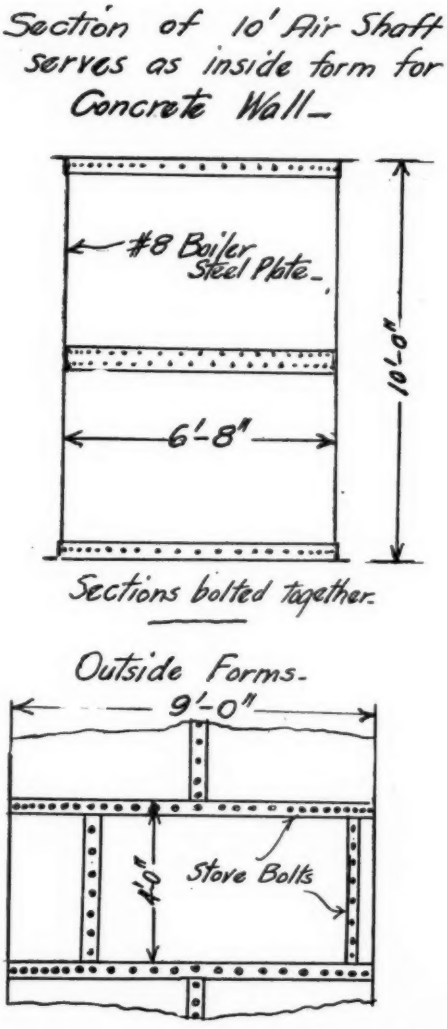
at the ground surface. The water-bearing stratum is struck at 60 feet below the surface, and the sand at this point is so fine that it is but a short time after the construction of a well until it becomes choked up with sand passing thru the perforations of the casing, and a new well is necessary.

The city finally determined on the sinking of a large steel well as the best solution of their problem. This well is 9 feet in outside diameter and about 6 feet 8 inches inside diameter, made up, first, of a so-called strainer section 20 feet long, whose final position is in the water-bearing strata, and five ten-foot sections of so-called air shaft. The strainer section consists of two cylinders attached and braced together, one inside the other, both perforated with about 40 per cent. perforation. At the bottom of the section the inside cylinder flares out to the diameter of the outside cylinder, as shown in sketch, forming a cutting edge for the sinking of the well. This strainer was hoisted up and set down vertically in a square shaft 12 by 12 feet, excavated to a depth of 20 feet and provided with guides for keeping the steel casing in plumb. The annular space between the perforated cylinders was then filled with gravel, forming a filter for the water to pass thru.

The work of excavating was carried on with a nine-foot orange-peel bucket operating inside of the steel cylinder, allowing the casing to settle as the sand was removed from the bottom. As this work progressed the ten-foot sections of air shaft and outside forms made up of 1/16-inch boiler steel were added and the space between filled with concrete, producing a weight of about 2 tons to the running foot. The work was continued until the entire casing was in place, the cutting edge of the strainer section being 80 feet below the surface of the ground and the top of the air shaft at a point 10 feet below the surface, this distance being brought up with a square concrete shaft 8 by 8 feet inside measurement, after the work of excavation was completed. The inside diameter of the strainer section is 6 inches less than that of the air shaft, leaving a small offset, on which a heavy steel bulkhead plate was placed. This bulkhead is provided with a 24-inch opening in the center, around which is bolted a 24-inch cast-iron blind-flanged cylinder 30 inches high to serve as manhole, and three other openings for suction pipes and sounding valve. Two feet of rich concrete was placed on the bulkhead and on this were built the foundations for a direct-connected horizontal centrifugal pump and motor, designed to deliver up to 500 gallons of water per minute against a total head of 95 feet.

The work of sinking this well had been so carefully planned that there was scarcely a hitch in the job from beginning to end. However, there were some difficulties which arose which might be interesting to discuss for the benefit of engineers and contractors contemplating similar work.

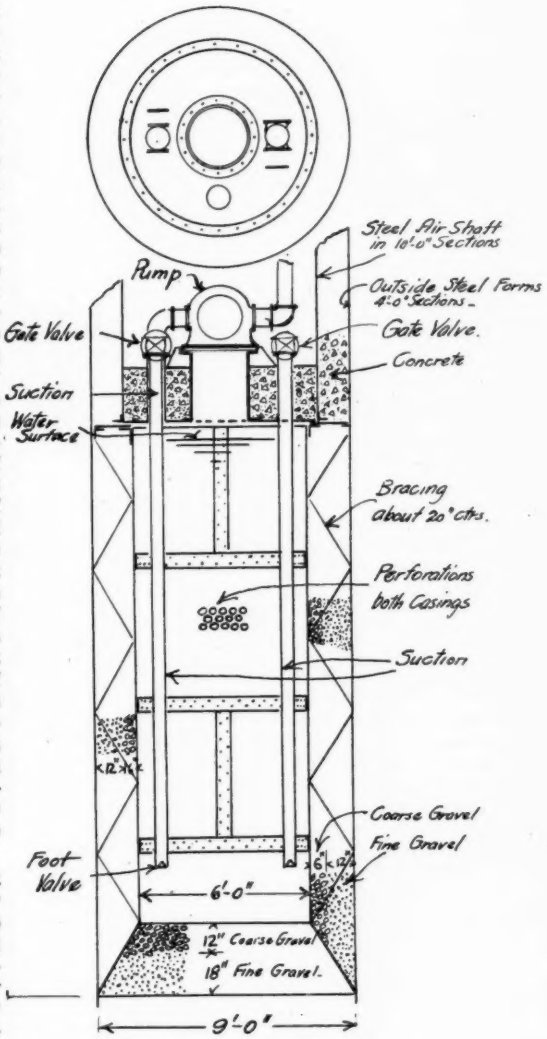
At the outset the work of sinking the casing was a very simple matter, there being such an abundance of weight in the casing and the amount of friction small. Every bucketful of sand removed was a telling one, causing the casing to drop from one to six inches. However, when a depth of 40 feet was reached it became very noticeable that friction was playing its full part and more weight was needed to keep the casing traveling at a rate corresponding to the amount of material removed. It might be well to



point out here the effect of insufficient load on the casing. In this event the excavation may be carried on until a great deal of material has been removed from outside of the casing, this material sliding in as each bucketful is withdrawn. Finally a point is reached when enough sand is removed from the outside to equalize the retarding force due to skin friction with the load of the casing, at which time the casing drops. The result of this excess excavation is to disturb the ground surface in the vicinity of the well, displacing the sheeting with which the preparatory square shaft is timbered, and destroying the purpose of the guides. Great care should be used in work of this kind to prepare adequately for load necessary to cause the casing to sink without the removal of any excess materials. It was found that, upon reaching the water-bearing strata, the rate of increase of resistance due to friction was greatly reduced, and with the addition of more load rapid progress was made until at a point about 70 feet below the surface the materials were so compacted that it was almost impossible to operate the orange-peel bucket with any degree of success, the bucket removing sometimes half a cubic foot, sometimes nothing at all. On account of the close proximity of two other wells the use of dynamite was forbidden, so a heavy chisel bar weighing about 1,000 pounds was made, this being hoisted up to the top of the well and then dropped. By continuous operation of this bar and bucket the full 80 feet was finally accomplished and the balance of the work completed.

Comparing the two types of wells at Galesburg it is readily seen how superior the large well is to the small wells. Tho the initial cost is greater, it will be noted that the difference in the cost of operation in favor of the large well pays for the difference in initial cost within a very short time. Assuming the cost of production of electric current at 2c per k.w. per hour, and noting that each small well requires a 27-h.p. motor, whereas the large well produces twice the amount of water delivered by one small well with a 20-h.p. motor, there is an approximate saving of $10.00 per day in the operation of this well over the others for an equal amount of water delivered. Again, in maintaining this well it is noted that it is practically impossible for sand to pass thru the 18-inch wall of gravel placed in the strainer. However, in the course of time as this does occur, it is a simple matter to remove the blind flange of the 24-inch cylinder and clean out the sand with a small orange-peel bucket or other device.

As to the method of construction, that is, sinking the well, it is very much more satisfactory than attempting to excavate



Sketch showing Strainer Section in final position.

and curb up, since the lateral pressures exerted by the strata to be penetrated are a source of great trouble and difficulty, and serious cave-ins are likely to occur as a result of imperfect timbers and faulty work in sheeting up. It is suggested, however, that in cases where the top soil and clay extend down a considerable distance, the excavation can be carried thru such strata and sheeted up, and the deeper such excavation can be carried the greater the reduction of friction on the casing after the sinking progresses, and the greater the effective load of the casing.

This type of well admits of a variety

of pumping methods, all of which may be installed and operated with great economy over the types of pumping machinery used in the small bore wells. With the installation of the pump on top of the bulkhead, as at Galesburg, it is still often possible to have it set underneath the level of the water strata, so that the necessity of priming is done away with, all parts of the pump, however, being in the dry air shaft.

The total cost of the large well at Galesburg amounted to about $7,000.00, including pump and motor, and while this figure might form a basis for computing the cost of similar wells, yet various conditions are apt to alter the case quite materially.

This work was done under the personal supervision of James F. Seiler, chief engineer of The Willis Shaw Machinery Company, New York Life Building, Chicago.

Importance of Meter Inspection

W. J. Spaulding, Commissioner of Public Property, Springfield, Ill., has the following to say regarding meter inspection and repair:

"In the average American city, I think the use of meters is almost indispensable. They are especially an advantage here because extravagance is characteristic of Americans. We are also impatient and intolerant toward what might be considered petty regulations. Rules regarding the use of water, which I understand are strictly enforced in some European cities, would be looked upon here as pestiferous. The meter will automatically and effectually do the work of many rules and inspectors. It seemed to us that to expend large sums to develop our plant and increase the supply while a large portion of the daily pumpage was getting away without doing anybody any good, would be like adding waste to waste. Our first step, therefore, was to install meters. This at first was left optional with consumers, but was encouraged in two ways; first, by the city furnishing the meter at its own expense and maintaining it so far as ordinary wear and tear is concerned; and second, because the consumers usually enjoyed a saving over the old fixture rate.

"It is necessary only to make the patrons understand that conservation means in the end lower rates and better service for them. The proposition is simple. For example, if 10,000,000 gallons are pumped thru the mains, and only 5,000,000 gallons devoted to legitimate use, the 5,000,000 gallons of waste must be added to the bills of the consumers the same as if it had been used. If the 5,000,000 gallons which were wasted had been sold, it is obvious that the rates could have been reduced 50 per cent. and the water department still would have received the same gross income, less the cost of additional mains.

"One matter that should not be overlooked with reference to the meter problem is that a meter is a machine and will get out of order. A water system might better not be metered at all, at least from a revenue standpoint, if the meters are to be installed and then allowed to take care of themselves. I think it is a serious mistake for the consumer to own the meter. The water department should own, install and take care of meters, and so keep its records that it can show the history of every meter from the time it was installed down to date.

"One point which should be urged upon the managers of municipal plants is that meters are of little value in conserving the water supply or as a means of equitably spreading the charge for the use of water unless there is adopted a system of testing meters at regular intervals and keeping them approximately accurate. In our opinion a test should be made at least once every two years. Meters which have been in service from eight to ten years are apt to under-register anywhere from ten to ninety per cent. When meters are found out of order they should be promptly replaced with accurate ones. The custom which prevails in some places of estimating bills one period after another because the meter is out of order, is, to say the least, very discreditable from the standpoint of efficient management.

"In the summer of 1911 we started a test of all meters which had been in service more than two years, the test made at the premises. These tests showed that about four meters out of five were from 5 per cent. to 90 per cent. slow. It should be explained, however, that these meters had been in for from two to twelve years. Most of them had been in service eight or ten years. To illustrate, we removed a meter which had been yielding 75 cents per month in revenue, and replaced it with an accurate one. The revenue at this place rose to $13.00. Reference to the ledger showed the registration had been gradually falling off for several years. Of course, the consumer felt greatly aggrieved and assumed that he was being robbed, but was finally convinced that he was wasting a great deal of water and by a change in management cut his bill down to about $4.00 per month, which in his case might be considered normal. This is only one of the many similar cases. I think it is safe to say that on all meters that had been in more than eight years we were losing 40 per cent. in income on the average.

"Following is the total cost of meter repairs for the year ending March, 1912:

Total No.	Name of Meter	6 Inch	4 Inch	3 Inch	2 Inch	1½ Inch	1 Inch	¾ Inch	⅝ Inch	Total Amount	Total No. repaired	Av. cost per meter repaired
653	Crown	.....	.....	$ 3.62	$16.76	$ 9.36	$44.03	$ 72.26	$549.01	$ 699.82	452	$1.55
1,775	Buffalo	.....	.....	.....	.....	2.02	6.13	6.72	130.33	145.20	174	.83½
2,101	Lambert	.....	.....	.....	.....	.....	2.16	.....	106.54	108.70	121	.90
96	Trident	.....	.....	.....	.....	.....	1.68	9.62	17.29	28.59	39	.73
46	Keystone	.....	.....	.....	11.27	.....	.....	.....	5.43	16.70	13	1.28½
45	Nash	.....	.....	.....	.....	.....	17.82	8.43	15.21	41.46	21	1.97½
20	Empire	.....	.....	.....	.....	.....	.68	.....	7.53	8.21	7	1.17½
54	Hersey	.....	.....	14.22	7.06	.....	2.63	.73	4.40	43.02	18	2.39
39	Badger	.....	.....	.....	.....	.....	.....	.....	22.44	22.44	13	1.72½
53	Standard	.....	.....	.....	.....	.....	.....	.....	.94	.94	2	.47
26	Worth	.....	.....	.....	.....	.....	.....	.....	3.81	3.81	9	.42
2	Gamon	.....	.....	.....	.....	.....	.....	.17	.....	.17	1	.17
5	Gem	.....	.....	.....	1.22	.....	.....	.....	.....	1.22	1	1.22
7	Rotary	.....	.....	.....	.....	.....	.....	.72	.68	1.40	2	.70
2	Thompson	.....	.....	.....	.....	.....	.....	26.73	.....	26.73	2	13.36½
4,924	Totals	$1.08	$17.08	$17.84	$36.91	$11.38	$75.13	$125.38	$863.61	$1,148.41	875	$1.31¼

"The plant also has single King, Westing and Hersey Disc meters, which were not repaired.

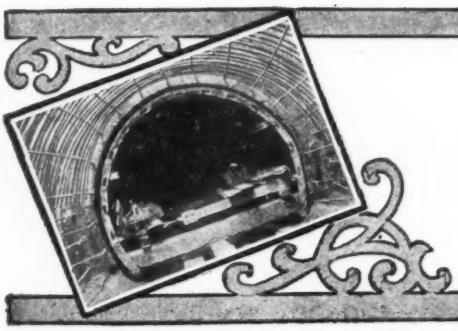
"The average cost of installing meters is about $1.50 (not including stop and waste). The average cost of installing meters in a pit, outside the building, is $7.50."

Outside installations are accessible at all times and those municipalities having outside installations can cut down their cost of meter inspection fully 50 per cent. Springfield has about 400 outside meter boxes, furnished by the H. W. Clark Company of Mattoon, Ill., 300 of which are of vitrified earthenware and the other 100 of concrete. The bottom of the box itself extends 6 inches below the frost line. The partial burying of the cover combined with dead air space within the box and the radiating surface of warm air at the bottom of the box insure protection from frost.

Glass Signs Adorn New Boulevard Lamps in Memphis, Tenn.

Boulevard gas lamps, like the one illustrated herewith, have been installed by the City of Memphis, Tenn., on Peabody and McLemore avenues, a part of McLean boulevard and Snowden Circle. It is probable that they will be installed at an early date on Central avenue. The lights are turned on and off automatically by a clockwork device, the effect of which is to greatly reduce the cost of maintenance.

The attractive glass signs, which have been combined with the boulevard lamps on Peabody avenue, are coming in for much favorable comment from citizens living in that section of the city. The advantage of these signs lies in the fact that they are as plainly visible at night as in the day time.



SANITATION

The Hill Motor Vacuum Street Cleaner

By Francis M. Weldon, Paris, France.

ALTHO the new Italian motor vacuum road cleansing machine is of recent date, it appears to be the appliance needed to clean city streets effectively. The machine was first put into practical use at Rome and Milan, where several of them are now at work. A Sheffield concern, the Hill Ordnance Works, has taken up its manufacture for the rest of Europe. The new cleaner works on the vacuum suction principle, drawing all mud and street refuse into the machine.

The automobile truck carries a 30-h.p. gasoline engine, upon which is fitted the vacuum device and a large storage body for holding the refuse. Driven by chain from the engine is a large cylindrical brush five feet in length, which rotates within a sheet iron shell placed quite near the ground, the brush running at the high periphery speed of 5,000 feet per minute. It raises the sweepings part way round and then delivers them into the box body at the rear. Owing to the strong draught set up by the rapidly revolving brush, all dust, mud and refuse is drawn up by suction and the centrifugal force throws is into the collecting chamber and here compresses it tightly, so that quite a considerable load can be taken into the receptacle before emptying. Twenty different flat brushes of suitable fiber run along the length of the cylinder, and each brush works in a slide holder so arranged that all the brushes can be slid in or out at the same time by the simple movement of a lever so as to come in contact with the ground. Thus the brush pressure is well adjusted, and the brushes can be used down to very near their base. Another lever at the driver's seat serves to raise and lower the brush cylinder as a whole. As the movement of the brush is quite independent of the car drive, by using a separate chain drive for the cylinder the brush can be run forward or backward in case of need and can keep on running even when the car is stopped, or the car may be run on the road with the brush lifted and out of action.

A well-designed container serves to hold all the refuse, and for this purpose there are used two, three or even more separate sheet iron boxes, all mounted in line across the well-closed box body and just back of the brush, so as to receive the material as the brush delivers it. As much as 50 cu. ft., or a weight of 2 tons, can be held in the inside, and this is unloaded most conveniently and quickly by letting down the hinged back door onto the street so as to afford an inclined way, the several boxes having wheels for running them out to the ground level for emptying. In practice the loaded car can be quickly run to headquarters for emptying, or in other cases it can be followed by a cart or power wagon. The machine can also be designed so that the box body part serves as a trailer and can be separated from the front part for this purpose. The brush is well enclosed at the bottom by a suitable apron made of leather and metal so as to run over irregular parts of the street surface, and a separate driver's lever raises this screen when need be, especially for back driving of the car.

At the official trials held at Manchester, England, mud on the streets, due to wet weather, and other material put on expressly for the purpose, such as clinker, ashes and various kinds of refuse, were cleaned successfully. On Oxford road, Mosely street and others the automobile had to run among heavy traffic and was quite successful in this respect. The machine left a very clean surface of 5-foot width, taking up mud, sand, paper, clippings and even good-sized pieces of brick and wood paving blocks. Dry cleaning was tested within a large shed with ashes, straw and dust strewed on the ground. The cleaner absorbed all this refuse without raising any dust. For this reason and because decaying material is tightly enclosed and gives no smell, the work is done under healthy conditions for the public. The machine can also take up

snow and water and can be used rapidly after heavy falls of rain or snow without inconvenience to passers-by.

In Southport the total street area swept was 2,933 square yards, and refuse collected, 2 tons, at speeds of 6 to 10 miles an hour, the time taken, including emptying of bins, being 18½ minutes, delivering three loads of refuse. Time taken to empty the boxes, 3 minutes. Gasoline consumed, 1/14 gallon (12 to 20 miles per gallon). Chauffeur, attendant and cost of gasoline (adding also depreciation, upkeep, etc., of cleaner) bring the total cost of cleaning as estimated for an area of 12,000 square yards to $1.08. Cost of cleaning by one horse sweeper and one cart, $2.93. By comparison of these two figures the great saving in cost will be easily seen.

THE HILL *motor vacuum road-cleansing machine, an Italian invention.*

In Milan, Italy, the actual work of sweeping is found to be for the automobile cleaner 100,000 square feet per hour of service, and for a horse sweeper and its cart the work is 33,593 square feet an hour, the machine being three times as fast as the old method.

The Refuse Incinerator at Moose Jaw, Canada

By F. Cartlidge, Sanitary Engineer.

The incinerator at Moose Jaw, Saskatchewan, Canada, was erected by Heenan & Froude, of Manchester, England, in 1912, at a cost for building, plant and chimney of $50,000.

The installation is a 3-cell plant of the high-temperature type, rated to destroy 40 tons of mixed refuse per 24 hours. Provision is made for an additional cell to be added when required, which will make it a 4-cell unit, increasing the capacity at least 33 per cent.

The grate area is 90 feet. The furnace bars are of cast iron, gutter shape, perforated to permit the free passage of air into the whole body of burning refuse.

Each cell front is fitted with a sliding cast-iron door, fire-brick lined, suspended and operated by means of a wire rope and balance weights for easy manipulation.

Along the center of the bottom of each furnace is a sliding drawbar; to the far end is attached a plate shaped to the section of the furnace, which, when withdrawn at the time of clinkering, is intended to clear out the contents of the cell into an iron wagon run on an iron rail track. This is operated by means of a light winch, which is moved opposite to the particular cell to be clinkered. So far this has not been of much use to us, as very little clinker is made with the class of refuse burned, and it is often more expeditious to clean out the ash with hand rakes into iron wheelbarrows.

The air blast is usually maintained at a pressure not exceeding 3 inches in the ash pit and a temperature of 150 to 200 degrees F. The air for this purpose is drawn from above the floor of the charging platform, thus removing any foul odors that may arise from the storage of refuse, is passed down a shaft 2 feet square, drawn thru a suction fan 3 feet in diameter, 590 revolutions per minute, driven thru a regenerator at the back of the boiler, where it is heated by the hot gases that have passed under the boiler and before reaching the chimney, and into the ash pit, from where it is driven thru the perforated furnace bars into the burning refuse. Arrangement is provided for regulating the amount of air passing into the fire, and while cleaning is in process it can be shut off altogether. The engine to drive the suction fan is a Heenan high-speed self-lubricating one of 12 h.p. at 268 r.p.m., under a steam pressure of 30 lbs.

The cells are arranged side by side in one continuous chamber, so that each grate is of mutual assistance to the others, being charged and clinkered alternately.

Adjoining and in communication with them is a combustion chamber of ample capacity for the thoro mixing and complete combustion of the gases.

The fires are charged from the charging platform above into sheet-steel hoppers, each 1 1/3 cubic yards capacity, from which the refuse is discharged onto a small drying hearth at the back of each cell by removing sliding doors, which are operated from the clinkering floor. This can be done without opening to the at-

mosphere, thus maintaining the heat in the furnace during charging operations.

Next to the combustion chamber is installed a Babcock & Wilcox water-tube boiler, with a heating surface of 1,700 sq. ft., over which the hot gases are passed and are available for the generation of 100 to 150 h.p. at 120 lbs. pressure per square inch.

The entire furnace combustion chamber and boiler settings are of pressed fire brick, with well-set arches and corners rounded off, built on a substantial concrete foundation to prevent the possibility of any settlement. The building housing the plant is of local brick, approached on one side by an inclined driveway, up which the wagons are taken for unloading onto the charging platform. On the latter is storage capacity for about 50 tons of refuse, or equal to a day's accumulation. A self-contained radial brick chimney, 4 feet 6 inches by 120 feet, is erected close to the building to carry off the waste gases from the furnace. This chimney was built by the Canadian Kellogg Company, of Montreal.

The plant was completed and put into commission in July, 1912, after a 24-hour test conducted by the builders, with the following results:

OFFICIAL TESTS, MOOSE JAW INCINERATOR, JULY, 1912.

Date of test, July	25-26
Duration of test, hours	24
Grate area, sq. ft	90
Heating surface of boiler, sq. ft	1,700
Ratio of heating surface of boiler to grate area	18.8 to 1
Av. temp. of feed water, deg. F	45
Av. temp. of combustion chamber, deg. F	1,750
Highest temp. of combustion chamber, deg. F	2,000
Lowest temp. of combustion chamber, deg. F	1,400
Av. steam pressure, lb. per sq. in	125
Weight of refuse burned, tons	53.51
Weight of residual clinker, tons	11.625
Percentage of clinker	21.73
Refuse burned per hour, tons	2.23
Refuse burned per sq. ft. of grate area per hour, lb	49.6
Total weight of water fed to boiler, lb.	59,700
Equivalent weight of water from and at 212 deg. F. fed to boiler, lb.	72,655
Water evaporated per hour, lb	2.487
Equivalent water evaporated from and at 212 deg. F. per hour, lb	3.027
Horse power developed (34½ lbs. water evaporated per hour into steam from and at 212 deg. F., 1 horse power)	96.6
Water evaporated per lb. of refuse, lb.	0.56
Water evaporated from and at 212 deg. F. per lb. of refuse, lb	0.68
Cost per horse power per hour, cts.	1.154
Cost per ton of refuse destroyed, cents	51.8
Actual amount of steam available for power per lb. of refuse, lb	.44

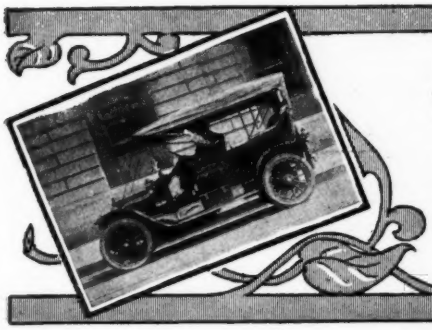
The low evaporation per pound of refuse burned is accounted for by the fact that the safety valves were unable to carry away all the steam generated. The door of the first compartment of the boiler being kept open the greater portion of the test, allowed cold air to rush in and cool down the gases. This was done to avoid any danger caused by an excess pressure being generated on the boiler. During this test the steam rose considerably above blowing-off pressure.

A second test, on July 31, 1912, of eight hours' duration, was made to ascertain the evaporation of water per pound of refuse burned. During this test 14,342 lbs. of refuse were burned, the evaporation working out at 1.125 lbs. of water per pound of refuse. In both instances when the tests were made the weather was fine and refuse burned was in a comparatively dry state.

More recent observations, made under ordinary working conditions, show an average evaporation of 0.86 lb. of water per pound of refuse. Working the full day of twenty-four hours with dry refuse, 50 tons are usually burned, leaving 25 per cent. of residue in the form of ash. No attempt is made to sort out the refuse except removal of the tins too large to pass thru the fires. Less than 50 per cent. is house refuse, the balance being chiefly stable manure and miscellaneous waste. Small carcasses, dogs and pigs are disposed of by burning in the combustion chamber. A special hopper filled from the charging floor is proposed that will obviate the necessity of opening the doors of the combustion chamber to destroy the large quantities of wet fruit that will not burn in the furnaces. No arrangement was made for the burning of large carcasses, such as horses and cows, but in more recent plants the makers have remedied this defect.

For some months no use was made of the steam generated by the waste heat, except to drive the fan engine, nor of the other residuals. Some of the steam is now utilized for pumping sewage, for washing closet pails and heating adjoining building. Very little clinker is made, and that of small size, but some has been used for the top layer of the bacteria beds at the sewage disposal works, and the fine ash is now used as a base for disinfecting powder.

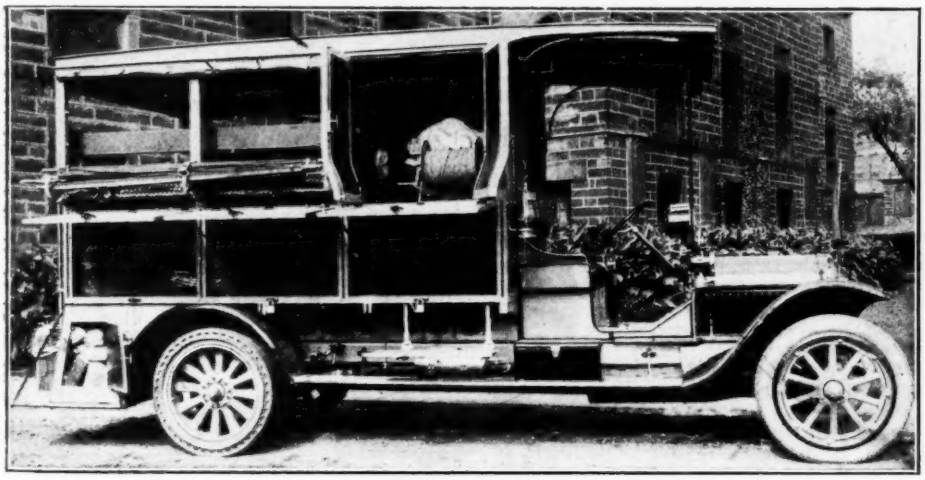
The income from these sources and the sale of bottles and other material will run about $2,500 per year.



Automobiles in Municipal Service

Motor Trucks to Rescue Entombed Coal Mine Victims

To rescue, revive and treat entombed and injured miners and thus reduce the loss of life and lessen the injuries resulting from the periodic disasters in the coal mines of the United States, the Bureau of Mines of the Department of Interior has evolved a new plan of relief work involving the extensive use of motor rescue trucks of a special design equipped with all the paraphernalia known in the science of relief work.



WHITE MOTOR TRUCK *equipped with everything necessary for a mine rescue corps.*

The first vehicle of the new type, built according to government specifications, was constructed by The White Company of Cleveland, Ohio, and delivered to the Bureau of Mines in Pittsburgh, Pa. It is a veritable hospital, carrying every piece of portable equipment that is useful in rescuing miners, quenching flames, resuscitating the unconscious and administering first aid.

Included in the equipment are two pulmotors, six oxygen tanks, fifty regenerators, an oxygen pump, two stretchers, a life line, box of explosives, lanterns, tents, fire extinguishers, complete telephone system and a full complement of hose, axes, saws, miners' tools and medical and surgical supplies. The equipment is complete even to the extent of providing for the bird and cage that are used in detecting poisonous gases in mine shafts.

A majority of the members of the American Mine Safety Association, who saw the first truck in operation during their recent convention in Pittsburgh, predicted a big reduction in casualties. A mine explosion, with all its effects except human injury, was staged during the convention. The truck with its full equipment was tested by government representatives while moving picture operators, also employed by the government, recorded every act and movement to show absent mine operators how lives can be saved and danger lessened.

The Bureau of Mines has proposed that mine owners in each district establish motor rescue stations at central points, from which each district may be served.

Inasmuch as instant access to everything is essential, the truck body has been built with a special place for everything it carries.

Under the driver's seat are carried ten Draeger reviving outfits. Six oxygen tanks are carried beneath the body on a specially built sub-frame and cradle, the tanks lying crosswise of the truck so that they may be pulled out quickly when necessary. On the left side of the chassis frame there is attached an oxygen pump, which is operated by the power of the motor. In back of the driver's seat there are hooks for a five-foot crowbar and tent poles.

Immediately in back of the driver's seat and extending the full height of the truck there is a series of compartments opening on the outside of the truck. These compartments carry a tent, 22 feet of hose, three miners' picks, three miners' shovels, one four-pound sledge and two hand axes. In back of these compartments are two seats, arranged lengthwise, with folding lazy-backs and protected by a brass railing. Beneath the seats there is a series of smaller compartments. Beneath the rear steps there is another compartment with doors at each side and in the end. There are also shallow drawers to take saws, hose couplings, reducers, spanners and 200 feet of half-inch rope.

The central compartments along the sides of the body contain one life line reel, a telephone system, part of which is carried into the mine, and an assortment of compasses, braces, bits, chisels, hacksaws, blades and snatch blocks. Suspended on the outside of the body on specially designed hooks and clamps are stretchers, fire extinguishers, axes, lanterns, etc. Two special boxes are built on the running boards to accommodate a large number of mine lanterns and small boxes are built on the rear wall of the forward compartment to carry two first-aid boxes and a pump. The truck is equipped with an eight-inch swivel headlight, mounted on the dash, and is fitted with non-skid tires. It is painted battleship gray with black striping.

An Automobile as a Locomotive

The accompanying photograph shows an automobile which has been fitted with flanged wheels and is used for hauling loads on a light railway. The turntable used is perhaps the most unique feature. The apparatus and its use is described as follows by J. A. Roberts, of Roberts Bros., railroad contractors, Chicago, Ill., the designers:

AUTOMOBILE *used as a locomotive, steel wheels, turntable always at hand.*

"The turntable which we use is a very simple device, consisting of practically six parts, namely, two inclined rails, two blocks and two bridle rods.

"To turn the machine we lay a short block in the center of the track, each end resting on a tie. On this we have a crosspiece or bolster at right angles with the track and drop a pin thru the two pieces, which holds the upper one in position. The rails are then placed on this crosspiece or bolster, and held to gage by use of the two bridle rods, above referred to, the tapered points of the rail resting on the track. The machine is then backed up on this turntable until it balances, when it is an easy matter to turn it either at right angles to run off the track entirely, or all the way around, if desired.

"The push cars attached behind the machine are not much heavier than hand

cars, and can be very easily lifted off the track by six or eight men.

"The tires used are regular locomotive tires, of course not so heavy as used for that purpose, but having standard flanges. The wheels on the machine shown in photograph are the wood wheels which came with the automobile, on which we put a heavier felloe, but we have found that they are not strong enough for the purpose, and are now equipping them with solid cast steel wheels, on which we shrink the same tires.

"The principal use we make of the machine is hauling our men to and from work while engaged in surfacing or ballasting railroad tracks. Our camps are usually located on sidetracks, when it is necessary to make runs of from one to six miles, in order to get men to and from work. We find it safe to operate at a speed of twenty-five miles per hour, which is a great deal faster than can be obtained by use of hand cars, and the men are not tired out when they reach the work."

Cutting Down Hauling Costs

It has been shown by various investigations that the cost of distribution adds a large percentage to the retail prices of all products of the farm and factory, and that transportation is an important item in the cost of distribution.

During the seventy years that steam railroads have been operated in America the cost of haulage by rail has been cut from 7 1/3 cents per ton-mile to 7½ mills. The price today is slightly higher than thirteen years ago.

Transportation by water is considerably cheaper than by rail, varying from one-half mill per ton-mile on the Great Lakes and the ocean, to 3 mills on canals from 5 to 10 feet deep. Such transportation is essentially long haul and in bulk. There remains the cost of moving freight from the producers to the shipping point and from the railroad freight yard and steamship pier to the factory or warehouse, the wholesaler and retailer and finally to the ultimate consumer. It is these repeated movements, each over a relatively short distance, that multiply the transportation costs.

In 1906 the Department of Agriculture estimated the cost of hauling twenty-three different farm products to shipping points from nearly 1,900 replies, from correspondents. At a little more than 23 cents a ton hauled by horse and wagon, the average length of haul being almost ten miles, largely over earth roads, only 8 per cent. of the roads being improved.

The only known way of reducing the cost of haulage by team is to improve the roads, but whatever gains have been made in this way probably have been offset by the increased cost of horses, hay and grain, labor and other items. Consequently, no relief has come from this quarter.

Apparently the only remaining hope for actual and substantial reduction of transportation cost lies in the commercial motor vehicle. No official investigation has been made into cost of operating motor truck and delivery wagon, but large users of these vehicles have demonstrated to their satisfaction that they are much more economical than horses, saving one-third to one-half.

Detailed reports of the operation of motor trucks and delivery wagons in the service of thirty prominent companies, engaged in various lines of business, in fifteen different cities, have been analyzed and show the cost of haulage and delivery per day, per mile, per ton-mile and per package. Wherever possible, the cost of performing the same service with horses and wagons was set opposite the figures for motor haulage for comparison. These horse costs were given in each case by the companies owning the motor vehicles from their own experience with horses engaged in the same service.

The results indicate that the average cost of hauling in the city by motor is 11¼ cents per ton-mile, as compared with 17¾ cents by horse. This represents a saving of 36 per cent. The average cost of deliveries by department stores, furniture, clothing and grocery stores, meat markets and electric light companies is shown to be approximately 8 cents by motor and 16 cents by horse, representing a saving of more than 50 per cent. by the former method. The analysis shows that the average cost of operating motor trucks and delivery wagons, embracing all sizes of both gasoline and electric machines, is $10.97 a day. This covers all items of operation and maintenance, such as driver, garage, interest and depreciation. The average cost of doing equivalent work with horses is $16.75 a day, which represents the expense of from two to three wagons, with drivers. Here is a saving of more than 34 per cent.

What the general use of these vehicles will mean to a community is indicated by some figures submitted by the head of a Chicago cartage company to the Chicago Association of Commerce. This report states that more than 250,000 tons of freight are hauled thru the streets of Chicago daily by team and motor truck and that this represents an annual business of more than $60,000,000 or about $25 a year for every inhabitant. There are more than 50,000 horse-drawn wagons and trucks in use in Chicago and about 4,000 motor trucks and wagons. When the 50,000 are converted into 20,000 mo-

tor vehicles, the direct saving in haulage will amount to from $20,000,000 to $30,000,000 or $8.25 to $12 a year each inhabitant, or about $35 to $50 a year for each family.

Reduction of traffic congestion, resulting from the elimination of more than half of the vehicles, will so expedite haulage that it can be done still cheaper by motor wagons. Real estate now devoted to stabling horses and wagons and the storage of hay and grain can be devoted to better purposes. Street cleaning costs and sickness and mortality resulting from street filth and the fly pest will be much less.

Again, the last census showed 24,000,000 horses and mules in the United States. Twenty-five per cent. of the total value of all agricultural products goes to feed animals to furnish transportation and power. Motor vehicles and traction engines, which consume gasoline, kerosene, coal and other fuels derived from inedible materials or from alcohol distilled from waste vegetable matter, can do most of this work and release this tremendous acreage of productive land for the raising of human food. The effect that this should have on the cost of food stuffs is obvious, altho it has not been estimated.

The Triple Combination Fire Engine

The following data submitted by Oliver E. Smith, engineer fire department, East Cleveland, Ohio, are based on the operation of a Robinson triple combination fire engine, chemical and hose wagon from January 1, 1913, to October 11, 1913:

Cost of repairs	0
Cost of lubricating oil	$12.18
Cost of gasoline, 208 gallons, average 18c per gal	37.44
Total cost	$49.62

Calls answered, 50; distance traveled, 93 miles; cost per mile 53.35 cents.

"This piece of apparatus," writes Mr. Smith, "is practically a complete fire department in itself and consequently appeals to cities which must economize in the number of pieces of equipment. In the case of small fires you have the chemical, and in quantities almost as great as that carried by the chemical, or chemical and hose alone; and the chemical in our experience is used successfully in three-fourths of all fires and is all that is required. If the water hose is necessary, you have it in as great quantities as are carried by the hose wagon alone; and you have the additional advantage of a set of pumps always ready to use with hydrant, cistern or river and with as much power as the steamer, and superior to the steamer in maintaining a steady flow of water thru a long, continuous period of service. You have with you, in case their use is necessary, an amount of ladders equal to that carried on any combination wagon, and the time consumed in reaching a fire over that consumed by the smaller wagon is so small that the greater equipment more than counterbalances the loss of time."

The following report by Thomas Ballantyne, chief of fire department, Savannah, Ga., shows the saving effected the first year in cost of building stations as well as in the comparative cost of maintenance by the installation of motor apparatus:

Estimated cost of horse-drawn steam engine		$4,800.00
Estimated cost of combination chemical and hose wagon		2,000.00
Two teams of horses at $300 per head		1,200.00
Four sets of harness		200.00
Harness hangers and incidentals		400.00
Fire station		7,000.00
Total		$15,600.00
Triple auto engine		$7,500.00
Accessories		350.00
Fire station		5,000.00
Total		$11,850.00
Saving in initial cost		$3,750.00
Maintenance of horse-drawn apparatus—		
Engineer per month	$80.00	
Captain per month	80.00	
Five firemen at $70.00 per month	350.00	
Upkeep of two teams of horses at $38.88 per team	77.76	
Total maintenance per month	$587.76	
Total maintenance per year		$7,053.12
Maintenance of Robinson triple combination auto engine—		
Captain per month	$80.00	
Mechanical engineer	80.00	
One fireman, per month	70.00	
Oil, gasoline, tires and repairs	14.82	
Total maintenance auto per month	$244.82	
Total maintenance per year		$2,937.84
Saving in maintenance for one year		$4,115.28
Total saving for first year		$7,856.28

MISCELLANEOUS

Production of Portland Cement in 1913

Acording to returns received by the United States Geological Survey up to January 12, 1914, it is estimated by Ernest F. Burchard, that the quantity of Portland cement manufactured in the United States in 1913 was approximately 92,406,000 barrels, compared with 82,438,096 barrels in 1912, an increase of about 9,967,000 barrels or 12 per cent. The estimated shipments of Portland cement during 1913 were 88,853,000 barrels, compared with 85,012,556 barrels in 1912, an increase of about 3,840,000 barrels, or 4.5 per cent. On account of a large surplus of production over shipments stocks of cement at the mills apparently increased more than 45 per cent., or from 7,811,329 barrels in 1912 to 11,375,000 barrels at the close of 1913. In 1913 the relations between production and shipments were the reverse of those for 1912, when shipments exceeded production. It may be necessary to revise considerably the estimates of stocks, but it is believed that these figures for production and shipments are close to those that will be shown by complete returns from all producers.

Altho few definite statements as to selling prices are at hand it is evident that the average value per barrel was appreciably higher than in 1912. Increases of 10 to 25 cents a barrel are reported from several plants in the Central and Eastern States, but there were slight decreases reported from a few plants in the Rocky Mountain district.

Two new plants, both in Washington, were added to the list of producers during 1913.

Public Relations

By J. H. Pardee, President The J. G. White Management Corporation.

Some of us can remember the early days of street railway development when the difficulties and problems which confronted the promoters and operators of traction properties were nearly entirely of a technical nature. The general public stood on the side lines, always interested, yet assuming no particular risk excepting perhaps in granting the right to erect poles and overhead wires in public streets for the distribution of the deadly electric current. The public cannot be said to have considered itself as a partner in the development, but rather that it was by outsiders who were willing to risk their fortunes on it. The consent of the public was sometimes given in view of possible service and anticipated commercial development.

Today the situation is very different; the public is indeed considered a partner in the management of the affairs of public service properties. Promoters may be confident that electric railways can be successfully built as far as the purely technical features are concerned; they must now make sure that their schemes have the approval of public opinion. The officers of street railway companies are now bearing heavy responsibilities in this new phase of utility administration, the guidance of public relationship. Traction lines are public servants existing for the comfort of the people and bearing to them certain well-defined obligations in the way of safe and adequate service at equitable rates; the public owes them fair treatment and protection from the indirect confiscation of their property by legislation, making it impossible to earn proper returns on investments in such property. Due to the failure of municipal ownership the public has found, after many costly trials of this inefficient method, that the most expedient and practical solution of the problem lies in the development of traction systems by private capital, together with proper and fair regulation by commissions representing the public interest.

From this comparatively new system of utility regulation have come a great many abuses of the regulatory power. Prompted by an ill-advised public opinion, and, in some cases, ignorant of actual conditions, commissions have been known to impose upon electric railways very onerous conditions, limitations, etc., which have so seriously burdened such companies as to actually set back their development to a very considerable extent by inspiring the ever-cautious money

lender with fear. Unreasonable regulation can, in the long run, harm no one but the public itself, for it automatically, by the very laws of economics, increases the date at which money can be drawn into this field of investment, and hence the rates which the public must pay for service. It is my confident belief that, in the abuse of regulatory powers, the pendulum has now commenced to swing back and that public service commissions are coming more and more to realize their obligations to security holders as well as to the sovereign partner, the public.

Having the greatest confidence in the general integrity of our American public, I believe most of the unfair burdens which have been saddled upon street railway companies with the consent of public opinion have been the result of gross misconception concerning the affairs and conditions of operation of such companies. The greater part of the general public knows very little about the electric railway business and are easily misled by those who picture them as monstrous monopolies, turning over tremendous and unwarranted monetary returns to their owners.

I believe, in general, that public opinion has come to realize that it, too, must endeavor to establish a harmonious spirit of co-operation between street railway companies and those whom they serve in order to arrive at the very best result for all concerned, and also believe we may expect to see a great improvement along these lines in the very near future.

Effect of State Regulation of Public Utilities

By William H. Winslow, President of the Wisconsin Electrical Association.

SUFFICIENT time has now elapsed since the passage of the original public utility and stock and bond laws to permit of forming a reasoned judgment on their results and tendencies.

As regards established utilities, their effect has, I believe, been, on the whole, beneficial—both from the standpoint of the public and that of the utilities. Certainly the belief that excessive profits were being received by public service companies must have been dissipated, as it is doubtful if in a single case returns have been disclosed more than equal to the minimum which a bank, factory or trading concern must earn in order to be called successful.

It has been said of these laws that they have taken the utilities of the state out of the field of speculation. As regards existing companies, this is perhaps both true and proper. Applied to new enterprises, however, it would be more nearly correct to say that they have made their financing difficult or impossible, and it is to this phase of the situation that it is desired to call particular attention. No laws can make hazardous enterprises (and all new ventures are more or less so) anything but speculative, and it is becoming apparent that the laws in question are stifling development and will continue to do so unless modified. This is a matter of fully as much importance to the people of the state at large as it is to the utilities; possibly even more so, for, while capital can find other outlets, the loss to the state resulting from arrested enterprise is positive and unescapable.

The plain facts of the matter are that in most cases money cannot be obtained for new ventures in the utility field, either by the sale of capital stock at par, or by the sale of bonds, or any combination of the two. That this is so is due to a number of conditions peculiar to quasi-public businesses,—among them the very large initial investment needed and small early returns received, and the fact that increases in investment are governed, not by the desires or convenience of their owners, but by the demands of the public. What is required is that speculatively inclined investors, who alone are attracted to such enterprises, be offered both a first lien on the property and a share in the profits over a mere interest return, when —and if—such profits are earned. This was formerly accomplished by the issuance of bonus stock, and very many people who were formerly violently opposed to such issues now realize that they were an economic necessity and entirely different from "watered stock" properly so-called. While bonus stock issues were economically sound and, within proper limits, in the public interest, rather than the reverse, they were open to the objection that they did not clearly show that their value was based on earning power only. For this reason, they cannot be—and possibly should not be—revived.

How, then, can the deadlock which appears to exist be broken? Apparently, only by legalizing the issuance of stock without par value, or profit-sharing certificates, as they are sometimes called, such as are now permitted by the laws of several of the states. Not only would such issues facilitate the financing of new enterprises, but they would make possible the consolidation of many small and necessarily inefficient plants, with great resulting advantage to the community served. The head of one of the large companies that has combined scores of plants in other states has stated that were issues of profit-sharing stock without par value permitted in Wisconsin, his concern would enter the state and, thru the well-known economies resulting from the sub-

stitution of a few large plants for many small ones, be enabled in many cases to largely reduce present rates.

While this is a matter that does not directly affect most existing utilities, we are all vitally interested in the progress and development of the state, and should, I believe, do what we can to further such an amendment of the stock and bond law as will relieve the present situation.

New York City Budget for 1914

The budget of New York City for 1914 is published in *The City Record* for December 2, 1913, and covers some 99 large pages. The total is $199,388,157.52, of which $192,995,551.62 is to be raised by direct taxation; $2,969,579.21 by sale of corporate stock (corresponding to municipal bonds); $1,168,176.11 from special and trust funds; $1,761,601.13 from water revenues; $438,433.95 from bridge revenues, and $54,815.50 from revenue bonds.

The Board of Aldermen and city clerk require $301,218.24.

The central administration of the city requires over $7,000,000; Manhattan central administration nearly $3,000,000; Bronx, $1,258,000; Brooklyn, $2,275,000; Queens, $2,000,000; Richmond, $722,000.

Schools require $39,500,000; census, $89,000; parks and public buildings, $3,300,000; police, $17,400,000; fire, $9,300,000; health board, $3,500,000; charities, $3,700,000; hospitals, $1,500,000; tenement house department, $767,000; water, gas and electricity, $7,500,000; street cleaning, $7,700,000; charitable institutions, $5,300,000; *The City Record*, $929,000; being a few of the principal items.

Technical Associations

The Indiana Engineering Society's program at its convention January 22 to 24, had the usual excess of papers which makes discussion all but impossible. Some of the papers were given in abstract or read by title as a consequence. One session had road building as its principal subject, another bridges and railways, another public utility regulation, and another the floods of March, 1913. Roads and public utilities had the most satisfactory treatment. The road question is the most behind in the state, while public service regulation, since the installation of the state commission last year, has had very reasonable success. Prof. Albert Smith, of Purdue University, was chosen president.

At the January 19 meeting of the New York Electrical Society, Dr. Elihu Thomson delivered a lecture on "The Wireless Transmission of Energy."

The program of the January 15, 16 convention of the Wisconsin Electrical Association was of unusual interest and two or three of the papers are given elsewhere in more or less completeness.

A paper on a universal datum plane for New York City was presented by Frederick W. Koop, at the meeting of the Brooklyn Engineers' Club, January 8.

The annual meeting of the American Society of Civil Engineers included the usual business meeting and trips of inspection of engineering works. On January 23 and 24 were held three sessions for the discussion of road construction and maintenance in accordance with the custom of the past three or four years.

The annual meeting of the New England Water Works Association, Jan. 14, was filled with valuable committee reports, a paper on construction of dams, by A. E. Walden, and the address of the retiring president, J. Waldo Smith.

The American Wood Preservers' Association held an interesting and important meeting at New Orleans, La., January 20 to 22. F. J. Angier, secretary, Mt. Royal Sta., B. & O. R. R., Baltimore, Md.

The program of the National Conference on Concrete Road Building under the chairmanship of Dr. W. F. M. Goss, begins Thursday afternoon, February 12, and closes Saturday, Feb. 14, at noon. It is full of papers and reports of committees by the foremost experts and covers all details of the subject from financing to joints and shoulders. Being held in connection with the Chicago cement show, it should be attended by most of those interested in the subject of good roads and good street pavements, in other words, by more than the Auditorium hotel convention hall can hold.

The National Brick Manufacturers' Association will meet in New Orleans, La., March 2-5.

Civil Service Examinations

The U. S. Civil Service Commission will hold examinations at the usual places as follows:

February 4: Assistant preparator in paleontology in the National Museum, Washington, D. C., at $60 a month.

February 18, 19: Laboratory assistant in petrography in Bureau of Standards, Department of Commerce, Washington, D. C., at $1,400 to $1,800 a year.

Technical Schools

The winter course in highway engineering at the Ohio State University, Columbus, O., will be held February 16 to 18 by the civil engineering department. The course includes about five lectures a

day for eleven days, to be given by well known road experts of the state and of the United States.

The extension division of Indiana University will hold at Bloomington, Ind., on February 5 and 6, a conference on taxation in Indiana which will be addressed by various experts on the question from Indiana, Wisconsin and New York and Indiana and other universities.

The department of sanitary engineering of Harvard University announces four new courses: one on demography for students in the school for health officers; one on rural sanitation for the same; one on elementary bacteriology; and one on municipal sanitary engineering. All the courses are specially adapted to students specializing in government and business administration.

The Columbia University graduate school of highway engineering presented lectures in January by such experts as W. H. Kershaw on handling of asphaltic oils, W. H. Connell on organization and methods of street cleaning, Paul D. Sargent on gravel in highway construction, Geo. W. Tillson on construction of street car tracks, J. W. Howard on European rock asphalts, and F. P. Smith on inspections of bituminous materials for highway use.

Personal Notes

Burdett Moody, formerly chief engineer of the water plant at Pasadena, Cal., is consulting engineer for the city of San Francisco in the Spring Valley water condemnation suit, working mainly for some time upon the valuation of the plant, estimated by the company's experts as high as $65,000,000.

L. Earle Thornton has been appointed city engineer of Pensacola, Fla.

Charles H. Eaglee for 9 years general manager of the Ambursen Hydraulic Construction Co., in charge of their construction work, has just become connected with the Aberthaw Construction Company of Boston, and will have charge of all dam and reservoir work for that company.

W. G. Chace, of Kerry and Chace, Ltd., Toronto, Ont., is chief engineer of the Greater Winnipeg water district in Manitoba. His experience has been with the International Railway Co. of Niagara Falls, Ont., the Temiskaming and Northern Ontario railway commission, the Ontario hydro-electric power commission and in Winnipeg with the design and construction of the municipal hydro-electric power plant, transmission line and sub-stations, besides smaller work for his firm.

Max V. Sauer is the chief of design in the Winnipeg office of the Greater Winnipeg water district and has had quite a varied experience in similar lines in the twelve years since graduation from college. The survey parties are in charge of five engineers, three of whom are college men of ten years' experience or more. They are Archie Paget with railway experience; Douglas L. McLean, with railway and hydraulic experience; A. C. D. Blanchard, with municipal experience in water, light, sewerage and as city engineer; Chas. J. Bruce, a surveyor, and George F. Richan, also a railway engineer.

The Houston plan of taxation, devised by J. J. Pastoriza, finance and tax commissioner of the city, is a striking advertisement, especially when presented as "a perpetual bonus to manufacturers and merchants."

Having been disappointed in securing Col. Goethals, the new city commission of Dayton, Ohio, which goes into office January 1, has appointed H. M. Waite, the outgoing city engineer of Cincinnati, Ohio, as city manager, with a salary of $12,500 a year.

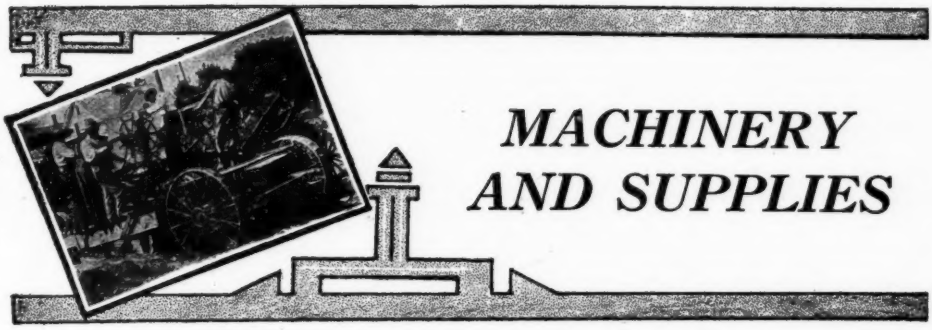
T. Chalkley Hatton of Wilmington, Del., has been chosen chief engineer of the new Milwaukee Sewerage Commission at a salary of $10,000 a year. The commission will spend some $15,000,000 in constructing and reconstructing a sewerage system and a sewage disposal plant.

Howard S. Reed, Asso. M. Am. Soc. C. E., for some years with the U. S. Geological Survey and the Reclamation Service, particularly the canals of the Roosevelt irrigation project, has opened an office for the general practice of municipal and irrigation hydraulic and water supply engineering in the Noll building, Phoenix, Ariz.

E. A. Kingsley of Little Rock, Ark., and R. C. Huston of Memphis, Tenn., have organized the Huston-Kingsley Company, incorporated engineers, with offices in both cities, to carry on the business of the two principal members of the company.

Mr. George L. Bean, who has recently severed his connection with the American Water Works and Guaranty Company owing to their financial difficulties, has been retained by Henry Floy, consulting engineer of New York City, to assist in the valuation of public utility properties, particularly water works plants. Mr. Bean was with the National Board of Fire Underwriters as hydraulic engineer for some years before going with the American Water Works Company, and has had a wide experience in making investigations, tests and reports.

Mr. Charles E. Raynes, mechanical engineer of New York City, has joined the engineering staff of Henry Floy, consulting engineer of New York City.



MACHINERY AND SUPPLIES

How Nearly a Whole Town Is Heated From One Plant

The Berwind-White Coal Mining Company has large works in and near Windber, Pa., a town with a population af 12,000, practically owned by the coal company and allied interests.

Some years ago the Windber Heating Company was formed and a large power house was built right at the entrance of the coal mine. This plant furnished power and light for the operation of the mine, electric light, power and heat for a large portion of the town. At the present time this heating company is under contract to supply heat for 58,000 feet of radiation. In all the early installations the pipe was insulated with wood covering. About a year ago one line was opened up and what was left of the wood covering was removed and J-M sectional conduit substituted. This proved so satisfactory that the company has recently opened up over 2,000 feet of steam line, taking it from the ditch and relaying it with J-M sectional conduit. Today it has in all a total of 3,325 feet of the J-M system installed.

The recent installation, of which some views are shown, is an 8-inch main line, running from the power house up a steep hill and down a stiff grade to the heart of the town, where it connects the branch mains. There is no return line on this system, live steam being carried into each building at a low point, so that the return will flow back into a trap, from which it is allowed to go to waste.

Several difficult conditions had to be met, such as the line passing thru coal veins and hard pan, thru which surface water strong in sulphur percolated. Naturally this chemical water rapidly ate the steel pipe away after having soaked thru and eaten away the old wooden protection pipe, and it was necessary to remove a considerable quantity of pipe, altho it had only been in three years. In one place, as the picture shows (Fig. 1), a hole had eaten in the pipe nearly 2 inches in diameter. In laying this pipe line it was originally found necessary to cross under the gutter of a roadway which carried mine water strongly charged with sulphur. In laying the new conduit and pipe at this point, the course of the stream was temporarily diverted while the conduit was laid across its path. A concrete dam was constructed in the gutter with the conduit imbedded in it. This prevented the backfilling from washing away, securely held the conduit in line and kept it free of danger from sulphur water.

As originally laid the pipe was allowed to take

FIG. 1. STEAM HEATING PIPE *badly eaten by mine drainage which had run over it.*

the curvature of the ditch, with unnecessary strains placed on joints, resulting in their leaking. In laying the J-M conduit care was taken to secure the correct grade. The ditch was dug 3 feet wide and to the necessary depth. In the bottom of the ditch another ditch 9 inches deep and 12 inches wide was made. In this was laid a 6-inch diameter sub-drain, the bottom of which was covered with 6 inches of crushed stone of rather coarse grade. Upon this was laid a layer of fine chip stone, to form a fairly even bed for the bottom half of the tile conduit.

At every fifth section of tile was a supporting tee, with the bell of the branch down, and the base filled to the flow line of the conduit with rich concrete, as will be noted in the illustration (Fig. 2). In this concrete were set J-M roll frames with exactness as to height. These frames are designed to carry the entire weight of the pipe and permit it to move under expansion and contraction without placing any strain on the tile conduit shown in foreground of Fig. 2.

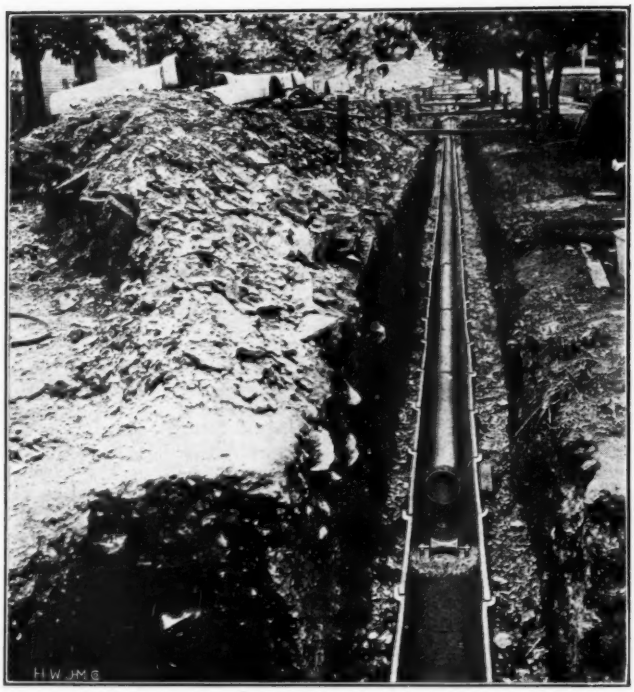


FIG. 2. METHOD OF LAYING *steam pipes for heating town, to retain the heat.*

The steam pipe was then laid and the expansion joints were placed in the line at proper intervals, to take care of the expansion and contraction of the pipe. All expansion joints were placed in manholes. Then the pipe was subjected to a hydraulic water test of 20 to 60 pounds according to the steam pressure to be carried in the line where the test was made.

The top halves of the conduit were then placed in position, the longitudinal joints being well washed with neat cement mortar and the bell joints were cemented to insure their being water-tight.

J-M asbesto-sponge filling was packed in the conduit all around the steam pipe. Crushed stone of medium size was then filled in until the bells of the second half were covered with 3 inches of stone. Then the ditch was filled up and tamped.

The manholes were made with 13-inch concrete foundation walls to a height even with the top of the lower half of conduit. The conduit was brought thru the manhole walls, so that the edges of the tile were flush with the inside of the walls. In order that the tile should have bell ends in the manholes, unions were used in laying the first sections on the down grade side of all manholes. Over these concrete foundation walls, brick walls were built and brought in at the top to the proper size to receive the manhole plates. Wherever the tile entered the manholes the pipes were covered with sleeves of J.-M sectional asbesto-sponge felted pipe covering and the openings around same closed with a shutter.

Aside from its simplicity and the facility afforded for its rapid installation, J-M sectional conduit possesses the characteristic of absolute imperviousness to water, dampness and acids. Being made from a special combination of stoneware, clay and other ingredients it forms a particularly durable protection for underground steam pipes where chemical action would attack and eat steel, wood and other materials. It is thoroly vitrified and salt-glazed both inside and out so that no moisture can penetrate it.

An additional advantage, found in the use of J-M sectional conduit is that by the nature of its construction, the weight or movement of pipes cannot injure the conduit. It can be opened up for inspection or removed and relaid without damage to the conduit. So carefully is J-M sectional conduit manufactured that the en-

tire process extends over a period of four weeks.

J-M sectional conduit has evidently very wisely been adopted as a standard for the heating lines in this very interesting mining city, because the first experimental section laid has thoroly demonstrated to the mining company's engineers that it forms the best and most economical system of heating conduit to be had.

There seems to be no reason, with the care used in laying the lines of pipe in the conduits, the full provisions made to take care of the expansion and contraction of the pipe, the durable character of all the materials used, why the whole installation should not be permanently satisfactory.

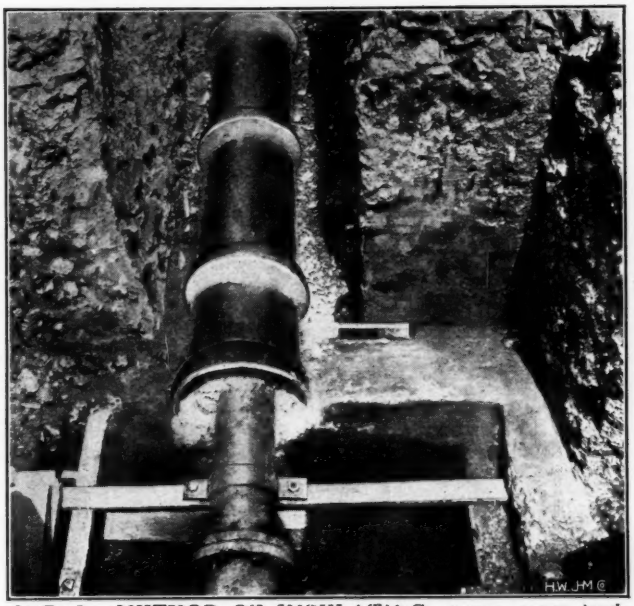


FIG. 3. METHOD OF INSULATING *steam pipes laid in the street.*

Test of Seagrave Motor Pumping Engine for Columbus, Ohio

By Chas. J. Lauer, Chief of Fire Department.

The city of Columbus, Ohio, made an official and acceptance test of the Seagrave motor-driven six-cylinder pumping engine on Monday, June 9, 1913.

This test was held on the banks of the Scioto river near Dublin avenue bridge under the supervision of the writer and Mr. W. S. Winnard, superintendent of machinery.

This engine, which is manufactured by the Seagrave Company, Columbus, Ohio, has stood a very severe test, which was exceedingly satisfactory to all concerned. The pump on this engine is of multi-stage Gorham centrifugal turbine type. The following data cover specification requirements and records of the four tests made:

SPECIFICATION *Requirements.*

Pump to deliver 1,000 gallons per minute at 120 pounds, pump pressure; 600 gallons at 200 pounds, 400 gallons at 250 pounds, all while drafting water from river.

CAPACITY *Test No. 1.*

Three lines 2⅞-inch C. R. L. hose, each 300 feet long, with 1¼-inch smooth-bore nozzles on each line.

Average pump pressure.....lbs. 190
Acerage nozzle pressure .....lbs. 58
Gallons discharged per minute..... 1,053
Duration of test .....minutes 30

CAPACITY *Test No. 2.*

Three lines 2½-inch C. R. L. hose, siamesed into standard Eastman deluge set with 2-inch smooth-bore nozzle.

Average pump pressure.....lbs. 180
Average nozzle pressure.....lbs. 67
Gallons discharged per minute..... 973
Duration of test.....minutes 30

TEST *No. 3.*

Three lines 2½-inch C. R. L. hose, 300 feet each, siamesed into a standard Eastman deluge set with 1½-inch smooth-bore nozzle.

Average pump pressure.....lbs. 200
Average nozzle pressure.....lbs. 130
Gallons discharged per minute..... 760
Duration of test.....minutes 30

TEST *No. 4.*

One line 2½-inch C. R. L. hose, 300 feet long, with 1¼-inch smooth-bore nozzle.

Average pump pressure.....lbs. 265
Average nozzle pressure.....lbs. 93
Gallons discharged per minute..... 445

All readings taken under supervision of W. S. Winnard, superintendent machinery, Columbus fire department. Hose fur-

nished by the Columbus fire department and was old hose with very great friction loss and the lines were very crooked.

A test of shutting off nozzles on three lines of hose simultaneously was made to show the flexibility of the pump, which was very satisfactory.

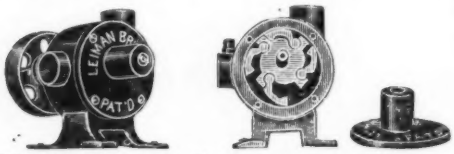
An Inexpensive Vacuum Cleaner

How many department heads have taken the time to consider the advantages to be derived from the use of a vacuum cleaning outfit? Probably some have discarded the idea, believing that the expense was too great. But a vacuum cleaning outfit, handled in the right way, can be installed with comparatively little expense, and nothing need be said in regard to the advantages to be derived from its use.

The municipal workshop or department will derive benefit not only on account of cleanliness in the plant and office, but from the use of the outfit for other work.

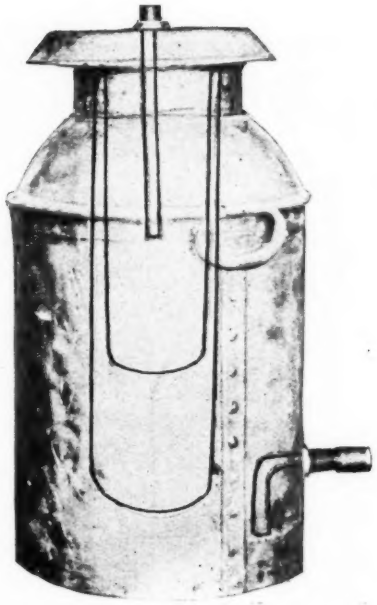
In connection with a vacuum cleaning outfit of the right sort there is generally supplied a rotary vacuum pump, such as is manufactured by Leiman Brothers, of 62 John street, New York City, which may be used for the suction in the cleaning operation, and also for blowing, and in this way becomes available for use in connection with a sand blast, blowpipes, gas furnaces, agitation, etc. In the shop the apparatus can be used for cleaning dust and dirt out of intricate parts of machinery, electric motors, etc., by blowing with the air jet, and for melting, brazing, annealing, etc.

We show herewith an illustration of how a simple dust-separating tank can be constructed. This is made of an ordinary 40-quart milk can. The cover of this can



BLOWERS *or suction air pumps for vacuum cleaning system.*

makes it an air-tight tank. A round hole is cut in the cover and a pipe connection made, as shown in detail in the sketch. The pipe or hose connecting the tank with the cleaning tool is attached at this connection. The connection from the can to the pump is made at the bottom in the same manner. The necessary screen is a bag made in suitable shape to set into the can about three-fourths of the way down, and to rest over the neck of the can in such manner that the cover will be drawn down over the top, holding it



DUST COLLECTOR *made from a milk can, which is very effective and inexpensive.*

secure. This bag may be made of canvas, canton flannel or suitable silk bolting cloth, depending on the amount of dust and dirt to be removed. The connection to the pump is made by means of a pipe nipple and union. The machine is now ready for operation, after attaching a belt to the pump from a motor or a line of shafting.

There is no doubt that a great many departments would find it profitable to install with the vacuum cleaning outfit a sand blast or gas furnace as labor-saving tools. The city departments in particular should be leaders in the matter of cleanliness, and therefore this system should appeal to them.

The pumps may be procured separately and the balance of the outfit assembled by any one with ordinary mechanical ability, or the entire outfit may be secured and the proper connections made. The pipe for blowing can be led from the pump to where the air blast is required, and used, as stated above, for the various purposes in connection with the regular routine work.

Asphalt Paving Record of West Chicago Park Commissioners

In his annual report, Mr. A. C. Shroder, superintendent and engineer of the West Chicago Park Commissioners, states:

"During the paving season of the year

1912, operations were continued with our own asphalt paving plant and employees in the laying of asphaltic concrete. The total number of square yards laid during this season aggregates 121,385, at a total cost of $77,789.26, making the average cost per square yard, 64c. The pavements were laid with an average thickness of two inches. The following is a list of roadways and drives paved during the current year with our plant:

Areas Paved.

	Square Yards.
West Drive of Independence Boulevard from Colorado avenue to Harrison street...	1095.0
Garfield Park—	
West Drive south of Madison street.....14767	
West, North and Center Drives between Madison and Lake streets.....23350	
North of Lake street..... 5021	
Total for Garfield Park.....	43138.0
Palmer Square Drives.....	21540.0
Washington Boulevard, 52nd avenue to Austin avenue.....	24472.0
Douglas Boulevard, Douglas Park to Independence Square	20048.0
East Drive of Independence Boulevard, Fillmore street to Independence Square	7306.0
Total area of drives paved during 1912	117599.0
Garfield Park walks.....2464	
Independence and Douglas Boulevard walks 882	
Total area of walks paved ing 1912	3346.0
Douglas Boulevard maintenance	440.0
Total yardage	121385.0
Total cost	$77,728.26
Average cost per square yard..	.64

Cost of Materials.

Crushed limestone per cubic yard..	$ 1.19
Torpedo sand, per cubic yard.....	1.55
Bank sand, per cubic yard.....	1.05
Crushed granite, per cubic yard....	2.95
Asphaltic cement, per net ton.....	17.95
Coal, average price per ton.....	4.65
Beach sand, per cubic yard.....	1.15

The following is a summary of the cost of asphaltic concrete pavements for the years 1910, 1911 and 1912:

Year.	Sq. Yds.	Cost.	Cost per Sq. Yd.
1910 ...	93,742	$63,373.99	64.59 cents
1911 ...	137,449	84,236.02	61.24 cents
1912 ...	121,385	77,789.26	64.09 cents

Total yardage paved.....	352,686 sq. yds.
Total cost	$225,399.27
Average cost per square yard..	63.91

Cost of Oiling Macadam Roadways in 1912.

302,700 square yards of macadam pavement were treated from one to three times during 1912. The following table shows the cost for the year:

Labor, superintendence and miscellaneous charges	1,056.28
Oil with asphaltic base, 7150 gallons at 6 cents.....$	429.00
Crude petroleum oil, 39,480 gallons at an average of .0346 cent	1,360.00
Teams, 130 days at $5.50 per day	715.00
Soap, 110 barrels at $2.50.....	275.00
Total .....$	3,835.88
Total square yards covered during 1912	302,700
Cost per square yard for year..	1.27c

Link Belt Machine Used.

The asphalt paving plants used by the West Chicago Park Commissioners are furnished by the Link Belt Company, Chicago.

The Small Town Plant

By A. W. Seng, Superintendent Municipal Water and Light Plant, Sylvan Grove, Kans.

Altho the village of Sylvan Grove has a population of but 600, it has been successfully operating its own water and electric light plant, which was installed during the months of November and December, 1911, at a cost of $22,699, by the Commercial Construction Company, Kansas City, Mo.

The city sells current to its patrons at 15 cents per kw. hr., $1.25 minimum. Water is sold at 25 cents per 1,000 gallons, $1 minimum.

Electrical service is given from one hour before sundown until 12 o'clock at night, and 5 a. m. until one hour after sunup, and Wednesday afternoons for ironing, etc, or about ten hours per day.

The city made a profit of about $200 during the months of December, 1912, and January, 1913, or a profit of about 50 per cent., but the average profit for the last six months was 33 per cent. However, most of this is used to pay for new extensions, meters, etc., and what is left goes into a sinking fund for upkeep of the plant.

Our engine and pumping equipment consist of: One 50-h.p., 2-cycle, Fairbanks-Morse oil engine, for running the generator and pumps; one 32-h.p., single Fairbanks-Morse oil engine for pump only; one 7 by 8-in. Smith-Vaile, triplex,

double-acting power pump, rated capacity 300 gallons per minute.

The power oil used is a 40-gravity distillate, which costs us 5 cents per gallon in tank-car lots.

One of the noteworthy features of our plant is the fact that the pump may be directly connected to either engine by clutch. Our engine will run pump and alternator at the same time, and when the pump is on there is not the slightest fluctuation in voltage. The particularly advantageous feature of the type of engine used is that it is exceedingly economical in operation. The engines can be started in less than five minutes' time and need scarcely any attention when running. They run with excellent regulation, having a gear-driven throttling governor, butterfly type, which regulates speed within 3 per cent. from no load to full load.

This plant has lost less than one hour's time due to shutdown and has run for more than four months at a time without a bit of trouble or stop.

The following is extracted from our financial statement for the year, January 25, 1912, to January 25, 1913:

Expense.

Fuel oil	$1,022.00
Lubricating oil	32.00
Repairs	38.50
Labor and salaries	1,555.00
Int. 5%, $35,000	1,750.00
Depreciation 4%	1,400.00
Total	$5,769.50

Income.

February 25, 1912	$128.60
March 25, 1912	93.48
April 25, 1912	141.92
May 25, 1912	161.27
June 25, 1912	170.91
July 25, 1912	236.91
August 25, 1912	197.97
September 25, 1912	266.04
October 25, 1912	231.52
November 25, 1912	319.40
December 25, 1912	330.49
January 25, 1913	321.76
Street lights	1,320.00
Water for sprinkling	240.00
Total	$4,160.27
To balance	1,636.23
	$5,796.50

Liabilities.

Bonded debt	$35,000.00
Interest at 5%	1,750.00
Expense	4,046.50
Total	$40,796.50

Assets.

Value of plant	$35,000.00
Sinking fund	300.00
Income	4,160.27
	$39,460.00
City levy	1,336.23
Total	$40,796.50

The above statement covers the first year's operation of our plant. Since January 25, 1913, we have been so rapidly increasing our line of customers that by January, 1914, the plant will undoubtedly show a 40 per cent. increase in income and efficiency. We are now operating the engines with an increased efficiency of 10 per cent., which will make a saving in fuel oil. Operating expenses have received a 20 per cent. cut, so that we expect to come out without a deficit this coming year.

Our electrical equipment consists of: One 2,300-volt, 3-phase, 37.5-k.v.a., 60-cycle Fort Wayne belted alternator; one 125-volt, 1.5-kw. Fort Wayne belted exciter; one 6-k.v.a., 2,200-volt Fort Wayne transformer; one 5-k.v.a., 2,200-volt Fort Wayne transformer; one 3-k.v.a., 2,200-volt Fort Wayne transformer; one 2-k.v.a., 2,200-volt Fort Wayne transformer; one 1-k.v.a., 2,200-volt Fort Wayne transformer; one 3-panel Fort Wayne switchboard; 104 110-volt, single-phase, 60-cycle Fort Wayne watt-hour meters.

Our one tungsten 35-lamp, 3.5-amp., series street lighting circuit is carried on three miles No. 8 W. P. copper wire; one mile 3-phase, high-tension No. 8 W. P. copper wire.

Our three miles of service lines, 110-volt, are carried on No. 6 W. P. copper wire.

Goodyear Launches Detachable Tread Tire

The Goodyear Tire and Rubber Company have brought out a new type of pneumatic automobile tire that possesses new features of great interest. It consists of a regular tire carcass—and a detachable tread. When the tire is inflated the tread can be removed easily, yet when properly inflated the two parts possess the strength and power of a one-piece tire. This makes it possible to replace either part—carcass or tread—in a few moments, anywhere, and means that practically a new tire can be obtained, if needed, at about half the usual cost.

The tread is held firmly to the carcass by the inflation of the tire. A secret construction that gives the edges of the tread an unstretchable bead, solves the problem of the necessary grip, and keeps the components safe from invasion by water or dirt.

It is worthy of note that no mechanical fastenings of any kind are necessary. This means there is nothing to impair the

resiliency of the tire, or add extra weight.

This new tire gives a greater protection from punctures than other types of pneumatic tires. The tread doesn't bear the tube strain and is therefore less tense than the carcass. Tests prove that a sharp object cannot readily pass thru a soft medium into a hard one without being deflected.

The tread is built slightly square on the inside, which provides air chambers at the two points of vibration on each side of the center of the tread. This prevents the possibility of injury to the carcass through overheating.

The two parts of this tire are built separately and to exact measurements. When put together they are a perfect fit. There is no loss of power, and no danger of the tread being forced off on a curve. The tread has a wearing surface of sharp-edged, wide-based blocks, which assure real protection against skidding.

Asphalt Pavements in New Orleans

By W. J. Hardee, City Engineer, Engineering Division, Department of Public Property, New Orleans, La.

Many of our streets paved with asphalt are so paved for their full length, varying from one to three miles, but the greater yardage of asphalt pavement is on sections only of streets, varying from one to three blocks in length, so that the names of streets paved with asphalt are very numerous and would have no special significance to readers of MUNICIPAL ENGINEERING, even if the limits within which they are paved would be stated, unless the reader would be familiar with the limits. Our first asphalt pavement was laid nearly thirty years ago by the Barber Asphalt Paving Company and to furnish not only the name of each street or part of the street paved but the year would require, under the circumstances, a very large tabulation. I am therefore confining myself more particularly to the length and yardage of asphalt pavements than the name of the street paved and the year in which the pavement was laid.

We have approximately 405,094 lineal feet of asphalt pavement roadway, embracing approximately 1,260,292 square yards. The cost of these pavements has from time to time varied, commencing with the first from $4.50 per square yard to $2.50 per square yard, which price has prevailed for the last fifteen years with slight variation either above or below, depending on local conditions surrounding the street to be paved.

All our asphalt pavement contracts provide for a five-year maintenance by the contractor. The majority of our asphalt pavements have been laid with Trinidad lake asphalt. The cost of upkeep and maintenance on this type of pavement is exceedingly low.

We own and operate a municipal repair plant, which has, during the five years of its existence, used Trinidad lake asphalt, California oil asphalt and Texas oil asphalt, altho as above stated Trinidad asphalt has been most extensively used.

The majority of our asphalt pavements are on residential streets and are therefore subjected to medium and light traffic both as to number and tonnage of vehicles, but we have in the business section of the city a number of prominent streets paved with Trinidad asphalt which is subjected to very heavy commercial traffic.

We have contracted for about 80,000 square yards of asphalt pavement which has not yet been laid, but in connection with which the preparatory work is now in progress. All our pavements are laid by contract and no portion is laid by the city.

Des Moines City Hall Furniture

The new city hall of Des Moines, Iowa, was planned and furnished under the supervision of four well-known firms of architects of that city—Liebbe, Nourse & Rasmussen; Wetherell & Gage; Proudfoot & Bird, and Hallet & Rawson. They incorporated in the designing of this building very unusual and elaborate features. The metal furniture installed was all built to order to meet the requirements of the various departments. We give in this article a brief description of some of the most important features of this metal furniture contract.

This contract was notable in the fact that it contained almost every filing device that was ever designed and made in metal. The work consisted of thirty-two cases, six counters, four bulletin boards and ninety-three clothes lockers.

The cases contained devices that were covered by doors, sliding or swinging, or steel curtains, or that were under a locking system that locked a nest or set of devices which was controlled and locked by a lever or device. Each device locked under a locking system was equipped with a hook that allowed the inserting and locking of the device after the locking system had been locked.

The swinging doors that were installed were made of heavy sheet steel reinforced with bars to insure a good working door free from all buckles and whips that occur in a large plate of steel. These doors were hung on heavy steel butts, which were riveted securely to the upright of the case and to the door itself. This overcame any possibility of the doors working loose and becoming noisy. These doors were locked by up-and-down bolts that locked in the cast at

the bottom and at the top, and were controlled in the center by a heavy cast bronze handle operating a latch that was locked by a good, substantial, flat key lock. Locking the doors in this manner prevented a person with evil intent to spring the doors open, in fact, making it impossible to open the doors without unlocking the lock with the keys supplied for same.

The sliding doors were made also of a heavy gage steel sheet and were operated on steel ball-bearing anti-friction wheels, two or more to each door. These wheels traveled in track drawn of heavy sheet brass. The wheels being of steel and running in a brass track, eliminated the noise that would be obtained if the track had been of steel. Where steel tracks are used it is necessary to enamel them to prevent rusting, and this enamel is worn off by the rollers traveling back and forth, which makes a very unsightly looking piece of work. The use of brass track overcomes this and insures a very neat appearance at all times.

Cases covered with steel curtains were equipped with curtains termed "duplex." These curtains are made in two parts, one part coming down from the top and the other part coming up from the bottom. These two parts are joined together by means of heavy steel chains operating over steel ball-bearing anti-friction rollers, which makes the curtains counterbalance each other, insuring perfect ease in closing or opening same. Where the curtains meet in the center they are locked by a heavy, substantial spring lock.

The curtains are made of a series of slats and are formed out of a light gage steel, which are interlaced together, forming a flexible, dust-tight covering which slides thru channels running vertically on the uprights of the case.

The devices, such as document files, card index files, legal blank files, scoop files, etc., were mostly of special size, made to take the different size blanks, papers and forms used by the various departments. These devices were made of light sheet steel formed up in such a manner to make a rigid and serviceable drawer. All fronts of devices were paneled to give a neat appearance and also for additional stiffness.

The roller book shelves were of various sizes and were made of a frame of heavy band steel riveted firmly together supporting steel rollers in the back and brass rollers in the front, which were raised up a sufficient height from the frame to allow the books to roll and not slide, thereby making the life of the covers of the books practically everlasting. The fronts of the uprights of cases containing roller book shelves were equipped with brass rollers running the height of the upright to protect the edges of the books when they were put in or withdrawn from the case. These rollers were held in place by brass clips secured to uprights, and rollers were pivoted on same in such a manner that they were absolutely noiseless.

The counters average about thirty feet in length and contain miscellaneous devices, roller book shelves and pigeon holes. These are covered by doors, either sliding or swinging, and steel curtains. The curtains in these counters are termed "simplex," being single curtains locking in under the ledge of the counter front and when opened disappearing down in the base of the counter. These curtains are counterbalanced by weights supported by chains attached to the curtains operating over anti-friction steel rolls. This insures perfect ease in either closing or opening the curtains. The construction of these curtains is the same as the "duplex" curtains before described.

These counters were supplied in some instances with finished wood tops and with finished steel tops. Where wood tops are furnished the counter is supplied with a heavy steel top underneath the wood top to act as fire protection. The wood tops supplied were 1½ inch thick, built up of five plys made in such a manner so as to prevent the warping of same. Where tops were supplied, made of steel, extra heavy plates were used and were enameled with enamel adapted for work where the service they are put to is severe. All fronts and ends of counters were paneled with applied molding, making the appearance very neat.

The bulletin boards were made of heavy steel covered with glass doors. In the back of these cabinets cork carpet ½ inch thick was put in for the purpose of taking tacks to hold notices, bulletins, etc. The doors were secured by up-and-down bolts and were locked in the center by a lock making a three-point locking attachment, making it impossible to unlock the cabinet without the use of a key.

The lockers in this contract were made entirely of steel of heavy gages formed up in such shape that would make a rigid and serviceable locker. These lockers were ventilated by means of round perforations or louvres formed in the doors. The doors were equipped with up-and-down bolts locked in the center by a lock, making a three-point locking system which guaranteed safety against persons with evil intent trying to spring the doors open without the key. Being made of steel thruout, these lockers were absolutely germ proof.

The entire contract was enameled in an olive green shade with all device fronts and panels of cases and counters striped

with neat, narrow stripe of gold. All work enameled is first covered with a filler that is absolutely rust-proof, which is baked on at a high temperature. The work then was enameled two coats of brush enamel, each coat being baked on separately and finally was covered by two coats of varnish, each coat baked on. The surface then was rubbed down with a solution and by a process to give the work a dull, waxed color.

The hardware, such as cupboard handles, drawer pulls, label holders, etc., were made of solid cast brass or pressed out of sheet brass. This trim was finished in "brushed brass," which, in connection with the "olive green" finish on the steel work, presented a very neat and effective appearance.

Operation of Diaphragm Pump

Some recent reports from contractors and others show the satisfactory use of the Atlantic diaphragm pump sold by the Harold L. Bond Co., Atlantic Ave., Boston, Mass.

One reports three weeks' work night and day without stopping, another 5 to 20 hours a day for many months doing as good work as when started with negligible expense for repairs. Many use the pump for taking water out of test pits, cellars, excavations, and the like. The floods of last spring in Indiana and Ohio gave a vast amount of work to this pump.

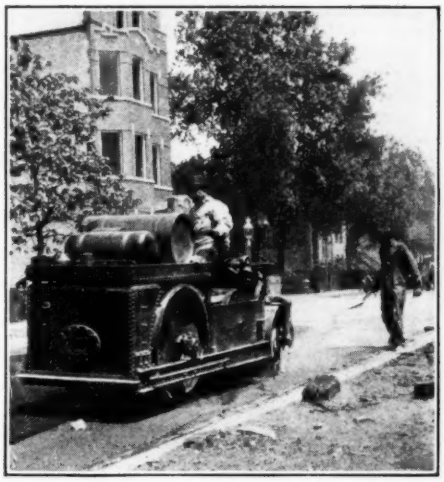
One pump takes the place of four men with two pumps. In another case when the pump ran continuously night and day it replaced four to eight men and use only 24 gallons of gasoline in 24 hours and but little engine oil, requiring very little attention and that at irregular intervals. Full information will be sent on request.

A New Pavement Roller

A new tandem motor road roller for rolling asphalt, brick and tarred pavements is put on the market by the Austin-Western Road Machinery Company, Chicago, Ill. The machine was exhibited for the first time at the recent American Road Congress and met with warm praise from practical road builders and paving contractors. The photograph shows the roller in operation.

As compared with earlier machines it runs steadier, has an easier and smoother reverse, and with two gear speeds and a power steering device, gives the operator better control. It does better work on account of the weight being hung lower, thus doing away with side sway and oscillation.

The machine shown is a five-ton roller,



TANDEM MOTOR ROLLER *for asphalt, brick and tarred pavements.*

with speeds of 2¼ and 3½ miles an hour, 33-inch front and 46-inch rear rolls, each 42 inches wide, 25-gallon gasoline tank, 60-gallon sprinkling tank and 100-gallon cooling tank. The six-ton size is ready for market and the seven and eight-ton sizes will be ready in January or February.

Trinidad Asphalt Streets in Indianapolis

Practically all the streets paved with asphalt in Indianapolis prior to 1894 were paved with Trinidad pitch lake asphalt. A recent inspection of the present condition of streets of those dates gave some interesting data which are gathered in the accompanying list. All these streets are now from 20 to 24 years old. It may be remarked in this connection that all the streets 20 years old or more in the city of Buffalo, N. Y., which were described in the January number of MUNICIPAL ENGINEERING were laid with Trinidad asphalt.

CONDITION OF OLD ASPHALT STREETS IN INDIANAPOLIS, IND.

Mississippi street (now Senate avenue), Washington to Ohio, laid 1890—5,377 yards. About half repaired and needs more.

Tennessee street (now Capitol avenue), Ohio to Washington, laid 1891—4,961 yards. Resurfaced 1911.

Meridian street, Twelfth to Fourteenth (now Twentieth to Twenty-second), laid 1891—3,000 yards. About half repaired; balance good condition.

Pennsylvania street, Fifteenth to Six-

teenth (now Twenty-third to Twenty-fourth), laid 1891—2,333 yards. About one-fourth repaired; good condition.

Ohio street, Tennesee to Mississippi streets (now Capitol avenue to Senate avenue), laid 1891—2,140 yards. About one-third repaired; good condition.

Market street, Illinois to Tennessee (now Capitol avenue), laid 1891—1,775 yards. About half repaired and needs more.

Seventh street, Alabama to Mississippi (now Senate avenue), laid 1891—11,290 yards. About one-fourth repaired; good condition.

Pennsylvania street, New York to St. Clair, laid 1892—9,925 yards. About half repaired; good condition.

Kentucky avenue, Washington street to I., D. & W. R. R, laid 1892—9,759 yards. About half repaired and needs more.

New Jersey street, Twentieth to Twenty-fourth, and Eleventh to Thirteenth, laid 1893—8,853 yards. About one-third repaired; good condition.

Talbott avenue, Fourteenth to Seventeenth (now Twenty-second to Twenty-fifth), laid 1893—4,984. yards. About one-third repaired; good condition.

Second street (now Eleventh street), Alabama to Central avenue, laid 1893—1,718 yards. About one-half repaired; good condition.

Prospect street, Dillon to Reed (now Shelby to State avenue), laid 1893—10,682 yards. About one-fifth repaired; good condition.

Massachusetts avenue, College to Bellefontaine, laid 1893—4,171 yards. About half repaired; good condition.

Pennsylvania street, Virginia avenue to Maryland, laid 1893—2,526 yards. About one-third repaired; good condition.

Arsenal avenue, Washington to Michigan, laid 1893—9,067 yards. About one-sixth repaired; good condition.

Illinois street, New York to St. Clair, laid 1893—14,206 yards. About one-half repaired; fair condition.

Unusual Truck Tire Mileage

The Union Transfer Company, which handles practically all the Pennsylvania Railroad Company's transfer business in Philadelphia, Baltimore and Washington, has solved the problem of getting the greatest possible mileage out of their motor truck tires.

One conspicuous instance of unusual tire mileage on their trucks is a transfer truck equipped with Goodrich wireless motor truck tires. They began hauling baggage in June, 1911. After the truck went to work, the owners were able to forget there was such a thing as motor truck tire to think about, because the tires on this truck never called for any attention until they had been in service nearly two years.

In January, 1913, the first replacement was necessary, when one rear tire which had run 12,900 miles was changed. In April following the other rear tire was taken off with 17,000 miles to its credit.

The front tires continued in service until May and September of the same year, when they were removed, having run 18,800 and 25,300 miles respectively.

Since the rear tires were changed, the truck has run 12,000 miles, and the tires are good for more.

In speaking of this unusual record, Mr. Brouse, the B. F. Goodrich representative in Philadelphia, said: "The secret of the whole matter lies right in the handling of the truck. It has been operated under good road conditions; it is never overloaded and never overspeeded. The driver resists the temptation to use the car tracks as a speedway. Any motor truck in normal service, handled as the Union Transfer Trucks are handled, should develop fully as satisfactory mileages."

Thompsonville, Ct., Hook and Ladder Truck

Thompsonville, Ct., has just recived its new hook and ladder truck built by the Knox Automobile Company, of Springfield, Mass., one of the finest vehicles of this type in service.

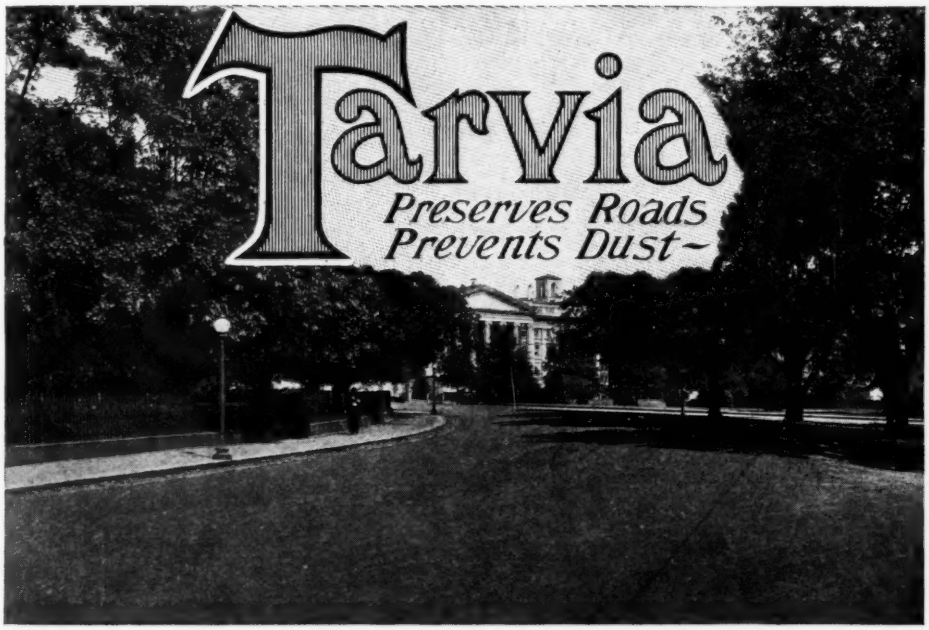
The motor driving the vehicle is of the standard Knox four-cylinder type with large reserve power and strong hill climbing ability. All the grades in the section covered by the apparatus were taken easily on the installation tests.

Briefly, the specifications of this vehicle are as follows: 40-gallon chemical tank; 200-foot hose; 55-foot, 45-foot, 35-foot, 25-foot, baby extension ladders, one each; two 24-foot, 12-foot roof ladders; one front bumper.

It also has an electric lighting system, electric self-starter, speedometer, clock, siren horn, sand horn, New Departure bell, full equipment of tools; in fact, it embodies everything necessary for the handling of a first class piece of fire apparatus. All tools are easily accessible and are carried in holders. The apparatus is fully adaptable to any size town or city and is a first class city service truck.

Circular Arc Corrugated Iron Culverts

The two accompanying photographs show two culverts of part circular form constructed for street work by the California Corrugated Culvert Co., the local



Road south front of White House, Washington, D. C. Showing U. S. Treasury building, Constructed with "Tarvia X"

In front of the White House

THE roadways leading to the White House, U. S. Treasury and State, Navy and War Departments, in Washington, illustrated above, were constructed with "Tarvia X" in 1911.

The above photograph shows the condition of these roadways two years later. They are quiet, clean, smooth and dustless, entirely suitable for so exacting a location.

The Tarvia forms a tough matrix around the stone, holding it firmly in place. Automobile traffic simply rolls down the surface and makes it smoother.

The maintenance cost of tarviated roads is insignificant, and their first cost is only slightly higher than that of ordinary macadam. Tarvia has no odor and does not track.

Tarvia is made in three grades—"Tarvia X" is a dense, viscid coal tar product of great bonding power, suitable for building Tarvia-macadam roads; "Tarvia A" and "Tarvia B" are thinner grades suitable for roads already in use, to preserve them and make them dustless.

Booklets free on request.

BARRETT MANUFACTURING COMPANY

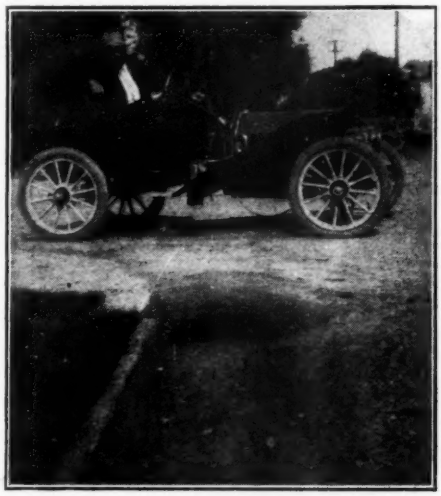
New York Chicago Philadelphia Boston St. Louis Kansas City Cleveland Cincinnati Minneapolis Pittsburgh Seattle Birmingham

The Paterson Mfg. Co., Ltd.—Montreal Toronto, Winnipeg, Vancouver, St. John, Halifax, Sydney, N. S.

TRADE B MARK

representative at Los Angeles, Cal., of the National Corrugated Culvert Manufacturing Co. The arch of these culverts is made of corrugated sheets of American Ingot Iron which is claimed to be 99.84 per cent. pure iron and therefore noncorrodible in ordinary use, but still further protected by galvanizing.

The lower part of these culverts is made of concrete with horizontal bottom of the concrete base and the top or surface on which the water flows sloping from sides toward center, which is 2 inches below the sides. A 2 by 2 strip is set in the edge of the concrete on each side, which is removed after the concrete has set, thus making a shoulder for the bearing of the edges of the corrugated iron. This shoulder should be very firm and solid and the use of a small angle iron in the corner of the shoulder to serve as a bearing for the arch of the culvert is recommended. After the corrugated iron arch is set, the space between its upper surface and the shoulder is filled with cement grout.



PART CIRCLE *American ingot iron culvert in Fresno, Cal.*

These part-circle culverts are made in sizes ranging from 7 inches base and 2 inches rise to 84 inches base and 42 inches rise (semi-circular) with metal of 16 to 10 gage.

Full information about the culverts can be obtained from the Armco Publicity Bureau, Cincinnati, O., B. G. Marshall, National Corrugated Culvert Mfg. Co., Middletown, O., or the California Corrugated Culvert Co., 409 Leroy St., Los Angeles, Cal., or West Berkeley, Cal.

PART CIRCLE *American ingot iron culvert, thirty-inch base, ten-inch rise. Note heavy traction road machine carried by culvert.*

Aztec Asphalt Pavements in Scranton, Pa.

The city of Scranton, Pa., in the past has been partial to asphalt pavements, about two-thirds of its mileage of durable pavements being of that material. According to the city engineer it gives general satisfaction and has the preference of property owners over other classes of pavements on account of its first cost as compared with others.

The specifications for asphalt are such that good asphalts of all brands can be used. Under them over four miles of streets have been reported as laid with Aztec asphalt. The accompanying table, prepared by the city engineer shows the data concerning the pavements laid with Aztec asphalt in 1912 and 1913, the first four streets named in the table having been laid in 1912 and the others last year.

The prices paid for these pavements are very reasonable, the asphalt pavements costing from $1.78 to $1.90 per square

Cut the Cost of Excavating, Conveying, Elevating and Dumping

Do it in one continued forward operation under the positive control of one operator, by using the

SHEARER & MAYER

Drag Line Cableway Excavator.

PATENTED

A Simple, Rapid, Efficient and Economical Machine for working over a wide area.

Digs equally as well from a wet or dry pit.

Write us your conditions and requirements and we will advise you if this machine is adaptable.

SAUERMAN BROS., 1141 Monadnock Block, CHICAGO.

ENGINEERS AND AGENTS

EVER COMPARE TAMPING COSTS

—THERE'S A BIG DIFFERENCE—

The Staley Power Tamping Machine

Not only does the work of from 6 to 10 hand tampers but it

DOES IT BETTER

Pavements can follow immediately over trenches that have been tamped by this machine without danger of future depression.

SENT ON TRIAL

—Straddles any width trench up to 4 feet.
—Eighty-five pound, 8x8 inches, tamp strikes 56 blows per minute at any point at any level from one to six feet below surface.
—Pounds dirt into solid, compact mass from bottom to top of backfill, thus obviating all sinking of trenches and consequent pavement repairs.
—Can be used for tamping sidewalk, paving, sewer and concrete construction.
—Special attachments for cutting asphalt and concrete pavements.

LOURIE MFG. CO. SPRINGFIELD ILLINOIS

yard. Five streets marked with stars are part asphalt and part stone block, and the prices given, $1.95 to $2.46, are the average prices for the entire streets, and are higher than the streets having asphalt surface alone because of the higher cost of the stone block surfaces. The yardage given in the table includes the asphalt alone, omitting the area of stone block.

	Length, Ft.	Sq. Yds.	Cost per Sq. Yd.
Price St., N. Main Ave. to N. Hyde Park Ave.	389.4		$1.85
N. Hyde Park Ave., Lafayette St. to Swetland St.	889.9	1,308.4	1.85
Swetland St., N. Main Ave. to N. Rebecca Ave.	1,895.8	6,082.3	1.85
Court St., Albright Ave. to Diamond Ave.	1,041.5	3,684.4	1.78
Prospect Ave., Locust St. to Fig St.	1,198.5	4,723.2	1.78
Willow St., Pittston Ave. to Prospect Ave.	572.5	2,255.0	1.78
Maple St., Cedar Ave. to Pittston Ave.*	434.5	1,319.6	2.26
Moosic and Front Streets	436.3	1,968.5	1.90
Kressler Ct., Centre St. to Linden St.	894.0	1,542.8	1.85
Lee Ct., Spruce St. to Centre St.	363.0	466.7	1.85
Monroe Ave., Ash St., to Poplar St.	526.0	1,992.3	1.85
Oakford Ct., Mulberry St. to Vine St.	526.7	895.3	1.85
Dupont Ct., Olive St. to Pine St.	512.6	858.3	1.85
Vine St., Kellum Ct. to Taylor Ave.	194.5	761.8	1.85
Walnut St., Capouse Ave. to Washington Ave.	1,184.5	5,485.1	1.80
Dupont Ct., Linden St. to Mulberry St.	527.0	931.5	1.85
Hitchcock Ct., Linden St. to Mulberry St.	438.0	770.8	1.85
Hitchcock Ct., Linden St. to Mulberry St.	526.0	907.6	1.85
Moir Ct., Linden St. to Mulberry St.	526.5	921.2	1.85
Pine St., Clay Ave. to Webster. St.*	365.8	739.1	2.45
Poplar St., Monroe Ave. to Quincy St.*	410.2	1,008.3	2.46
Elm St., Lacka. River to Cedar Ave.*	1,851.7	6,293.5	1.95
Mulberry St., Prescott Ave. to Arthur Ave.*	1,629.3	1,134.4	2.38
Totals	17,333.2	46,000.1	

*Price per square yard was for combination asphalt and stone block pavement on a concrete base, yardage given above is asphalt only.

H. B. Pullar Co.

The firm of Pullar & Enzenroth, Engineering Chemists, Detroit, Mich., has been reorganized, and in future will be known as the H. B. Pullar Co., Engineering Chemists.

Mr. T. C. Ford, B. S., Ch.E., A. M., formerly chief chemist for the American Asphaltum & Rubber Co., of Chicago, will become an active member of the new firm. Mr. Ford has for the last five years been closely associated with Mr. Pullar, and is thoroughly familiar with the testing of bituminous materials, and has had a wide experience in the actual building of many miles of roads and pavements thruout the United States and Canada. Mr. Ford was one of the first four engineers to graduate from the special postgraduate course of Highway Engineering of Columbia University, New York City.

The new firm will continue its business of testing asphalts, water-proofing, bitumens, oils and paints, and the inspection of roads and pavements. Will also be in position to draw up specifications and supervise construction of pavements, roads, bituminous floors and bituminous sidewalks.

The new plan for road and paving inspection which was devised by Mr. Pullar last year, will be considerably elaborated upon, and members of the firm believe that this plan for the inspection of roads and pavements, the testing of materials entering into them and the keeping of detailed records, will be of great interest to engineers and other officials interested in highway work.

The new firm will retain its location at 378 Woodward avenue, Detroit, Mich.

Permanency Is Keynote in Modern Road Building

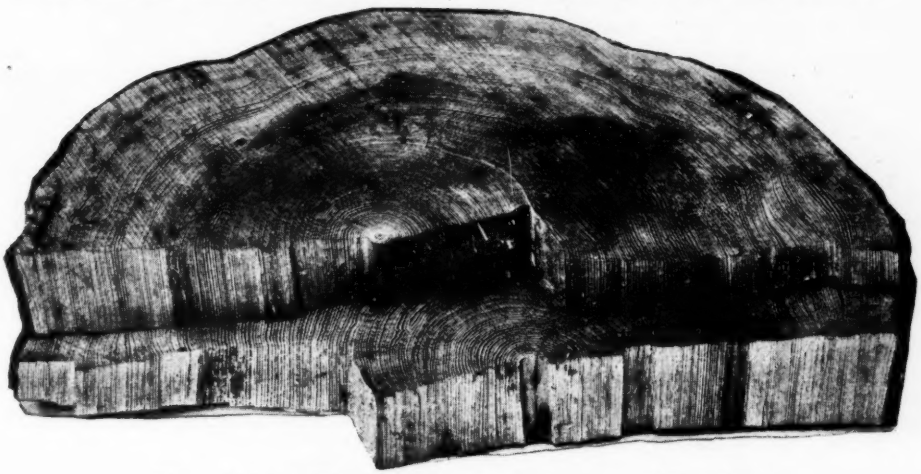
By Iverson C. Wells.

Permanency is the keynote of all modern construction work. Build today that posterity may benefit tomorrow is the cry in all public improvement. Temporary makeshifts no longer answer. We have learned the lesson of true economy. We know that building well today means less expense in the long run.

SOUTHERN YELLOW PINE

THE BEST WOOD FOR CREOSOTED PAVING BLOCKS

Because Its STRENGTH And SERVICE is NOT Affected BY CREOSOTING



Close Annular Rings, Dense, Hard, Strong and Durable.

Mr. A. B. McFarland, Engineer of Tests, Atchison, Topeka & Santa Fe Railroad System, at Topeka, after making extensive and thorough tests with Southern Yellow Pine Timbers (Bulletin No. 149, A. R. E. A., 1912) states:

> "The data shows conclusively that Long Leaf Pine timber which has been subjected to the full cell process of creosoting and allowed to weather for a year, ***is in no way inferior to untreated timber.*** When tested immediately after treatment, results show that treated timber to be slightly inferior to the untreated timber."

No such statements concerning "other structural woods now commercially available" are to be found, notwithstanding standard tests have been made by qualified investigators.

"Best timber for engineering structures where great strength, long span and durability are required."

The facts are, *Southern Yellow Pine* has made "Creosoted Blocks" a popular paving material, owing to its *great strength under end compression, dense, hard texture and uniform straight grain.* The resin this wood contains is a preservation in itself, so that Yellow Pine blocks, when properly creosoted, will insure absolute paving satisfaction for *years* in the most trying, congested traffic districts of our largest cities, namely, New York, Boston, Chicago, St. Louis, Atlanta, Cincinnati, Detroit, Louisville, Memphis, etc.

MR. ENGINEER: Hereafter be explicit. ***Specify "Southern Yellow Pine"*** for your next creosoted paving block contract. It makes an ***economical*** and ***desirable street pavement from every standpoint*** and gives ***longer*** and ***more efficient service*** for the money expended than any other pavement known to engineers.

No royalties paid for its use, and no large repair appropriations necessary.

WRITE FOR LITERATURE AND INFORMATION.

Yellow Pine Manufacturers' Association, 711 Wright Building, ST. LOUIS, MO.

In the great movement for better roads that extends from coast to coast and from the Great Lakes to the Gulf one hears the same cry, permanency, and that is the goal the highway commissioners and the road builders of the nation are striving to reach.

What is a permanent highway?

A permanent highway is one that is built of material that is durable, one that resists wear, that resists the destructive forces of nature, that withstands the ravages of time.

No road that requires constant repairs to keep it in a usable condition, that necessitates resurfacing or that must be rebuilt after a few years is a permanent road. A highway that does not outlast the bonded indebtedness that made it possible is a "gold brick" to the community that bought it.

There are two materials that make for permanent roads, granite block and vitrified clay brick. Either one of these materials is durable and wherever you see a road that has withstod heavy traffic conditions for years you will find that one or the other has entered into its construction. Roads built of clay brick 500 years ago in Holland are still doing service today. Streets paved with clay brick in London 300 years ago are still carrying the burden of the heavy traffic of the world's greatest metropolis. These roads are permanent roads.

A highway that only lasts from two to three years is not a permanent highway and yet the country is streaked with miles of just such roads because of a mistaken idea of economy.

In Cleveland, Ohio, and Cuyahoga county, the commonwealth in which Cleveland is located, there are several hundred miles of vitrified brick highways. Some of these were built more than a quarter of a century ago, but because they were constructed of permanent material they have not cost the taxpayers one cent in repairs and are good for many years to come.

In Terre Haute, Ind., there are brick paved streets that were constructed more than a quarter of a century ago and not one cent of repairs has been placed on them and they are as good today as they were when they were laid and they will continue to be of service for many years to come.

Vitrified brick is artificial granite. Man converts clay into this artificial granite by the same process that nature uses in making its product—by the application of intense heat, only he accomplishes his work in hours where nature has taken thousands of years.

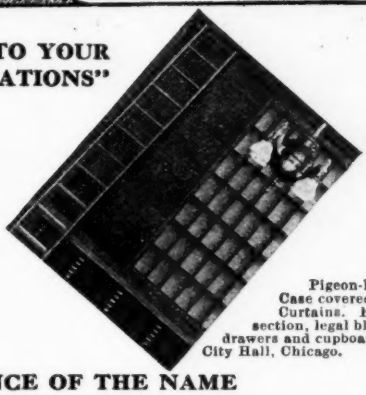
Vitrified brick being cheap and durable and obtainable almost anywhere, is a popular material.

While vitrified paving brick is a most durable road material, it must be used

CENTER ROAD *in Cuyahoga county, Ohio, laid in* 1909, *fifteen feet wide, concrete curbs, sand cushion. One of the cross-country roads which intersects a large number of the main highways of Cuyahoga county, and is therefore subject to heavy traffic.*

"BUILT TO YOUR SPECIFICATIONS"

Superintendent of Public Service Office, Cook County Court House, Chicago.



Pigeon-hole Case covered by Curtains. Base section, legal blank drawers and cupboards, City Hall, Chicago.

IS THE SIGNIFICANCE OF THE NAME

V—A—N—D—O—R—N

IN METALLIC FURNITURE

The City that Specifies

V-A-N--D-O-R-N Metallic Furniture

specifies the limit in Safety and Permanency

Steel Document Cases and Files, Roller Book Shelves, Steel Lockers, Steel Desks, Wrought Grill Work.

We'll be glad to send you proof of why it will pay

—To Have your New Equipment
—"BUILT TO YOUR SPECIFICATIONS"
—Without the Extra Cost.

The unique and structural designs afforded by Van Dorn methods insure the widest range of choice and the greatest degree of elasticity at the smallest cost—our engineers will be pleased to help you plan your systems according to your desires and suggestions.

Catalog on Request.

The Van Dorn Iron Works Co.

METALLIC FURNITURE DEPARTMENT

General Office:
CLEVELAND, OHIO.

SOUTH WOODLAND ROAD, *Cuyahoga county, Ohio, from center of Chagrin River road, in Orange and Warrensville townships. Fourteen feet wide, four-inch concrete base, concrete curbs.*

properly. Even a street or road constructed of Bessemer steel would give way if it were not properly laid. Poorly constructed brick streets or highways do not give the taxpayer the full value of his investment.

Built right, a brick street is as smooth as sheet asphalt, and improves in this quality as the years roll by. The streets of Cleveland, some of the most exclusive boulevards being of brick, are proof positive of this statement.

Built right, a brick street is sanitary, is no noisier than others, and has the advantage of being permanent.

There is but one method recognized by the National Paving Brick Manufacturers' Associaton for the construction of a No. 1 brick street or highway. Most of Cleveland's streets and the miles of highways in Cuyahoga county are built under the specifications indorsed by this Association.

Briefly stated, this form of construction calls for, first of all, proper drainage for the roadbed. The roadbed then must be rolled with a heavy steam roller. On top of this six inches of concrete is laid and permitted to harden. A cushion of sand is placed on the concrete and this is well rolled to form a smooth base for the brick. On top of this the vitrified brick are laid and a cement filler composed of one part Portland cement and one part fine sharp sand is poured between the interstices. On each side of the street expansion joints are placed and a curbing of either stone or concrete.

With a street laid in this manner a city has builded for the future, and the item of cost ceased when the last brick was laid.

In highway construction 4 inches of concrete usually forms the base, as the traffic conditions on the country roads are not as severe as in the cities.

The United States government has indorsed this form of construction and used it exclusively in its road construction in Panama. The government also will build several miles of vitrified brick road in Ohio as a part of the great national highway system and as a model for similar construction work, and has given that state financial assistance for the construction of the remaining miles of the national highway across the state.

Contrary to a popular idea, brick paved streets or highways cost but little more than, and quite often not so much as the best constructed streets or highways of other materials. They have the economical merit of permanency and freedom from repairs.

This One Thing—

"INHERENT STABILITY"

alone makes **Bitulithic** superior to other Bituminous Pavements. But **Bitulithic** has many other good qualities as well. **Bitulithic** Pavement is made of varying sizes of the best stone obtainable and bituminous cement, having density and ***"Inherent Stability"*** which a bituminous pavement must have to give the best results.

Bitulithic. East Main Street. Little Falls, N. Y.

Facts concerning **Bitulithic—**

Introduced in 1901 - 16,400 square yards laid.
Laid in 1913 - - 7,008,296 square yards.

Total yardage in 13 years in 296 cities throughout the United States and Canada, 29,672,003 square yards, equivalent to 1,686 miles of roadway 30 feet wide between curbs.

Its growth is not an accident, it is due to its great merit. You should study the cause of this wonderful growth, and if you are a municipal official it is your duty to know. Your city should be in the advanced line.

It cannot be there without **Bitulithic,**
The modern, ideal Permanent Pavement.

Bitulithic appeals alike to city officials, property owners and automobile drivers. Prepare at once, as the season of 1914 promises extraordinary activity in the street paving line. Make your contracts early. It is to your advantage.

We want to help you. If we cannot convince you **Bitulithic** is "Best by Every Test" no harm is done. But we know we can.

Write today for explanatory booklets and learn more about this modern Ideal Permanent Pavement.

Warren Brothers Company

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59 Temple Place, BOSTON, MASS.

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50 Church St.	10 S. LaSalle St.	305 Main St., West.	926 Calif. Bldg.	Journal Bldg.	204 Noll Bldg.

The Smith Mixer

The new catalog, No. 300, of The T. L. Smith Co., Milwaukee, Wis., is a work of art both in the telling of its story and in printing and illustrating it. Each two pages of the booklet are devoted to one of the points of excellence of the mixer for its various uses or to one of its appliances.

For concrete the double cones, discharge by gravity, single central drum ring, heavy frame, power dump, batch hopper, loader, extensible loader frame, encased gearing, geared loader, and special forms of machine are detailed.

For bituminous materials the hot mixer, combined mixer and heater, and its economy are detailed.

Besides the leaders and hoppers, the appliances described are side-gate cars, and four types of elevators for carrying concrete materials and the mixed concrete.

The catalog is well worth the card it will take to bring it.

Trade Notes

The Rock Island Bridge and Iron Works, Rock Island, Ill., have been awarded contract for all structural steel for Iowa Biscuit Co.'s. Burlington building, 260 tons in all; John Thye, Burlington, general contractor.

F. P. Wilcox, district manager of the Koehring Machine Co., has removed his offices to 214 E. 10th St., Kansas City, Mo., where he will handle a full line of contractors' supplies, including the Koehring mixers.

Notice has been received of the twentieth Luten decree, F. R. Gaines, of Kentucky, being the infringer this time.

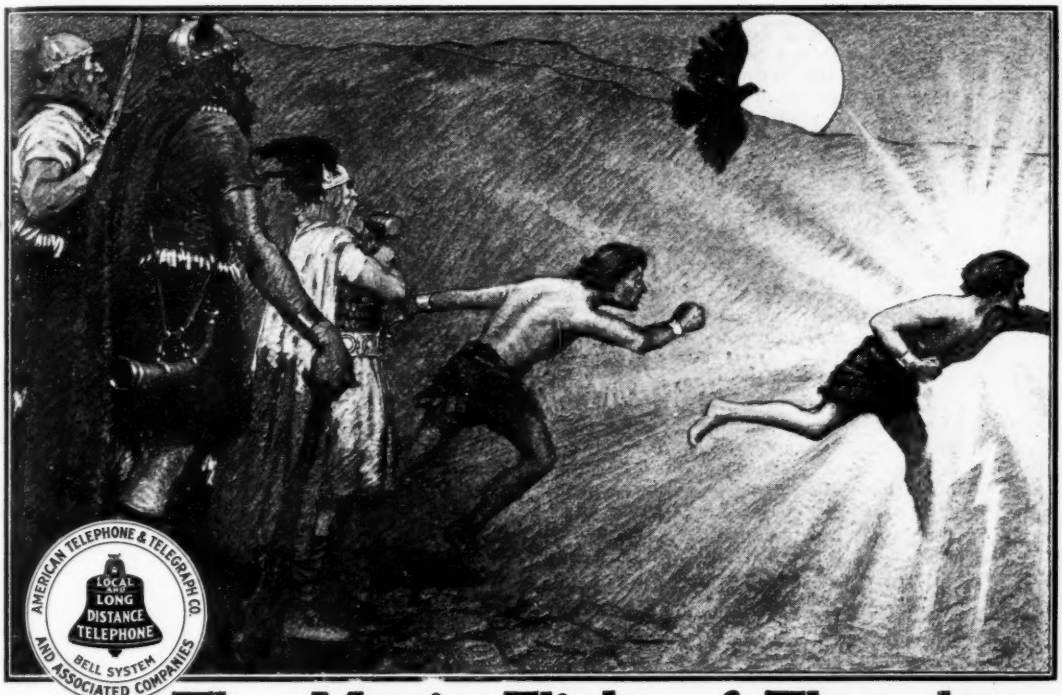
The plant of The Goodyear Tire & Rubber Co., Akron, Ohio, covers 50 acres, and has a floor space of 1,550,605 square feet, or 35 acres, giving employment to 6,500 people. The power plant has a turbo-generator capacity of 8,500 horse power, steam boiler capacity of 12,000 horse power, and an engine capacity of 7,250 horse power. It is possible for the Goodyear factory to manufacture 10,000 automobile tires a day in addition to the immense quantity of motor-truck, motorcycle, bicycle, and carriage tires that are regularly turned out. The mechanical rubber goods department, which was started less than a year ago, is growing rapidly, and the products of this department, such as belting, hose, packing, etc., are fast becoming recognized by the trade as equal in quality to the other products of the Goodyear Company.

The Cleveland, O., branch of the H. W. Johns-Manville Co. has recently been obliged to provide larger quarters for several of its subsidiary offices. The Columbus office and contract department are now located on the ground floor of the new seven-story fireproof Peters power building, 45 West Long street, with large warehouse facilities half a block distant. The Toledo office and warehouse have been moved to 213 Water street. This office has just completed a pipe-covering, stack-lining and cork-tiling job in the Second National Bank Building, Toledo, which possesses many unique features. Other Cleveland branch sub-offices are located in Akron (717 Second National Bank Building), Dayton (259 Fourth Street Arcade), and Youngstown (502 Stambaugh Building). Resident representatives are stationed at Lima, Massillon, Greenville and other points in Ohio, also at Huntington and Parkersburg, W. Va. Their work is supplemented by a large corps of traveling men. Last, but not least, the Cleveland branch has just closed a long-term lease for another larger warehouse on Front street which, when remodeled, will give the branch larger and better storage and shipping facilities than ever.

The Raymond Concrete Pile Co. will furnish approximately 2,700 concrete piles for the foundation of the 12-story addition to the Coca Cola Building, Baltimore, Md.; also approximately 200,000 lineal feet of Raymond concrete piling for foundation of retaining walls, abutments, etc., in connection with their Rock Island track elevation work in Chicago; foundations of abutments near Cooks, Wash., on Spokane, Portland & Seattle Railway; 1,500 concrete piles in foundation for the 16-story reinforced concrete building for Robert Gair Company, Brooklyn, N. Y.; concrete piling for the foundation of the new high school, Moline, Ill.; 2,400 concrete piles in foundation of new 19-story building for the Hallenbeck-Hungerford Realty Corporation, Lafayette and White Sts., New York; approximately 600 concrete piles for the foundation of new buildings for the F. W. Devoe & C. T. Reynolds Co., 9th and Smith Sts., Brooklyn, N. Y.

The MacArthur Concrete Pile & Foundation Co., 11 Pine street, New York, N. Y., has been awarded a contract covering the foundation of the retort building for the New Haven (Conn.) Gas Light Co. where about 600 pedestal piles will be driven; also one covering the concrete pile and reinforced mat foundation for the Brockton Gas Light Company's new gas holder, Brockton, Mass.; and covering foundations for the White Service Company's improvement on 57th St., near 12th Ave., New York City.

A. Reiche, formerly general manager of the Orenstein-Arthur Koppel Co., Koppel, Pa., who has served for many years in



The Magic Flight of Thought

AGES ago, Thor, the champion of the Scandinavian gods, invaded Jotunheim, the land of the giants, and was challenged to feats of skill by Loki, the king.

Thor matched Thialfi, the swiftest of mortals, against Hugi in a footrace. Thrice they swept over the course, but each time Thialfi was hopelessly defeated by Loki's runner.

Loki confessed to Thor afterward that he had deceived the god by enchantments, saying, "Hugi was my thought, and what speed can ever equal his?"

But the flight of thought is no longer a magic power of mythical beings, for the Bell Telephone has made it a common daily experience.

Over the telephone, the spoken thought is transmitted instantly, directly where we send it, outdistancing every other means for the carrying of messages.

In the Bell System, the telephone lines reach throughout the country, and the thoughts of the people are carried with lightning speed in all directions, one mile, a hundred, or two thousand miles away.

And because the Bell System so adequately serves the practical needs of the people, the magic of thought's swift flight occurs 25,000,000 times every twenty-four hours.

AMERICAN TELEPHONE AND TELEGRAPH COMPANY
AND ASSOCIATED COMPANIES

One Policy *One System* *Universal Service*

the above capacity and under whose supervision the plant has grown to be one of the largest and best equipped of its kind, and numerous branch offices in the States and in the West Indies have been established, has severed this connection to assume the position of managing director of a large German concern, manufacturers of locomobiles and agricultural machinery. His successor is Erich Joseph, who has also been connected with the Orenstein-Arthur Koppel Co., for a great many years, recently as New York manager.

The Des Moines Bridge & Iron Co., of Pittsburgh, Pa., and Des Moines, Ia., opened a contracting office at 50 Church street, New York City, on January 1, 1914. Mr. J. E. O'Leary, one of the company's contracting engineers, is in charge of the office. This office will handle the business in the coast states north of Virginia and in Eastern Canada. The Des Moines Bridge & Iron Company makes a specialty of the design and construction of hemispherical bottom steel tanks on steel towers for municipal, railway and industrial work.

Trade Publications

The Mississippi steam siphon for lifting small quantities of water small distances for portable engines and their tanks, and the like, is described in a circular of F. W. Shuls, Galion, O.

Standard specifications for making wear, dust, and waterproof floors are issued by the Master Builders' Co., Cleveland, O.

The manufacture of reinforced concrete poles, piles and pipe without the use of forms by the Jones process and patents is fully described with a prospectus of the National Reinforced Concrete Pole, Pipe, and Pile Co., of Denver, Colo.

Jeffrey coal and ashes handling machinery and single roll coal crusher are described in recent booklets of the Jeffrey Mfg. Co., Columbus, O.

The advantages of the Bayer front end tube blower are set forth in a circular of the Bayer Steam Soot Blower Co., St. Louis, Mo.

The Luten design bridges under construction in October, 1913, are shown in a 16-p. booklet which must be intended as general advertising of the name since neither name nor address of the National Bridge Co., Indianapolis, Ind., controlling the Luten patents, is given.

Reinforced spiral steel pipe is the subject of catalog 4 of the Standard Spiral Pipe Works, Chicago, Ill.

The Bessemer Gas Engine Co., Grove City, Pa., publish *The Bessemer Monthly* to give information about the use of their products.

The Grinnell Automatic Sprinkler Bulletin bearing date of January, 1914, is a handsome booklet of 16 pages, fully illustrated, published by the General Fire Extinguisher Co., Providence, R. I., which is full of information about the use of automatic sprinklers for putting out fires at their beginning. Ships and hotels receive special attention as classes of risks in which the automatic sprinkler is rapidly being applied.

Culverts of American ingot iron is the subject of an illustrated booklet of the California Corrugated Culvert Co., West Berkeley, and Los Angeles, Cal.

Water towers is the subject of a 1914 booklet of the Chicago Bridge and Iron Works.

The Linder steel reversible wheel road drag and steel reversible road grader are shown in a handsome circular of the Linder Grader Co., Matthews, Ind.

The Decarie Incinerator Co., Minneapolis, publish two booklets with much information about their method of garbage disposal, entitled "Incineration" and "The Mayor has an Interview with an Expert."

The Richardson Scale Co., Chicago, Ill., and Passaic, N. J., sends illustrated circulars of their automatic coal scales, for weighing large quantities of coal, coal for boilers and coal on conveyors.

The Frazier Machine Co., McKeesport, Pa., advertises a convenient brick carrier which is capable of ready adjustment to the work.

H. W. Johns-Manville Company issue a complete little pamphlet regarding the Audiffren-Singrun refrigerating machine for ice making and refrigerating which is practical for small work, such as domestic use, clubs, cafes, hotels, dairies, hospitals, etc.

Hand Book 41 of the Abendroth & Root Manufacturing Company, Newburg, N. Y., is devoted to Root spiral riveted pipe.

Instruction Book No. 3056 of the Fort Wayne Electric Works, Fort Wayne, Ind., is devoted to Type A Form A oil transformers, and Bulletin 1147, second edition, describes the same and methods of installing them. Bulletin 1145 describes Type ML three-bearing, belted, direct-current generators with balance wheels.

The road machinery catalog of the Wheeling Mold and Foundry Company, Wheeling, W. Va., comes in a loose-leaf binder and describes their forced feed crusher, conveyor for the same, stone elevator and screens. Their five and seven-ton tandem road rollers are now ready for delivery.

The Chain Belt Company, Milwaukee, Wis., in their December circular, show the great Allentown, Pa., viaduct and the St. Croix, Minn., bridge, in the construction of which chain belt mixers were used.

DO YOU WANT AN

Economical Efficient Permanent

Water Works System?

ECONOMICAL

Because your savings over small well systems will pay initial cost in two to four years.

EFFICIENT

Because every ounce of energy supplied does its full work.

PERMANENT

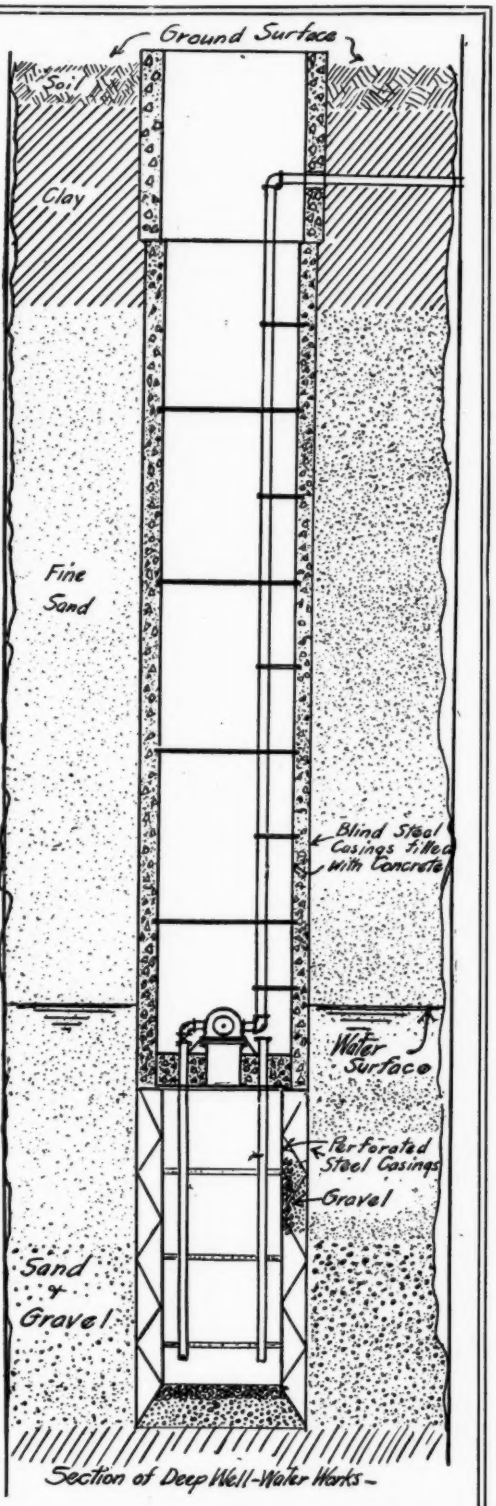
Because built of steel and concrete and can always be kept clean.

"Our Estimate is a Bid"

The Willis Shaw Machinery Co.

ENGINEERS AND CONTRACTORS FOR WATER WORKS AND IRRIGATION SYSTEMS.

N. Y. LIFE BLDG. CHICAGO.



CONTRACTING NEWS

ROADS AND PAVEMENTS.

BIDS REQUESTED.

Beaver Falls, Pa.—Until February 19, for brick paving of Hillside avenue in Patterson Heights Boro (Beaver Falls postoffice). The work includes 4,000 yards' paving, 2,400 lin. ft. concrete curbing, grading, etc. Carl S. Donaldson, engineer Beaver Falls.

Cincinnati, O.—February 13, until noon, for improvement of Wooster pike from Bamford Hills to the Miami river bridge at Milford in Columbia township. Albert Reinhardt, clerk board Hamilton county commissioners.

Clinton, Iowa—February 10, until 8 p. m., for two street improvements as follows: Tenth avenue, 9,940 sq. yds. of vitrified brick, concrete with a bituminous coat on top, creosoted wood block or asphaltic concrete paving; 4,000 lin. ft. combined curb and gutter. Ninth avenue, 7,300 sq. yds. of vitrified brick, concrete with a bituminous coat top, creosoted wood block or asphaltic concrete paving; 3,800 lin. ft. combined curb and gutter. Certified check $1,000. Frank W. Leedham, city clerk; J. G. Thorne, city engineer, 317 Howes block.

Fowler, Ind.—February 16, until 1 p. m., for construction of a macadam road on Benton-Newton county line. S. R. Sizelove, auditor Newton county.

Frankfort, Ind.—Until February 10, for the construction of ten roads in Jackson, Perry, Michigan, Sugar Creek and Union townships. C. F. Cromwell, auditor of Clinton county.

Mitchell, S. D.—February 6, until 10 a. m., for grading and improving highways in Davison county. Certified check 5 per cent. of bid. Date of completion, September 1, 1914. F. A. Zangle, county auditor.

Plymouth, Ind.—February 18, until 2 p. m., for improvement of certain highways in Union township and paving of one street in the town of Culver. George F. McCoy, auditor Marshall county.

Sioux Falls, S. D.—February 16, until 9 a. m., for construction of pavement as follows: On Phillips avenue from south line of Seventh street to south line of Thirteenth street. Estimated quantities: 14,000 sq. yds. of pavement outside of street car tracks; 2,300 sq. yds. of pavement along street car tracks. Material: Granite block, creosoted wood block, asphaltic concrete, bitulithic, portland cement concrete and dolarway. Certified check $2,000. And on Phillips avenue from south line of Thirteenth street to south line of Eighteenth street, about 9,500 sq. yds. of pavement. Materials: Creosoted wood block, sheet asphalt, asphaltic concrete, bitulithic, portland cement concrete, dolarway and tarvia macadam. Certified check $1,000. Walter C. Leyse, city auditor.

Spokane, Wash.—Until April 1, for surfacing 6½ miles of normal road from Sunset boulevard to Meadow Lake. R. W. Butler, county auditor.

Waseca, Minn.—February 6, until 2 p. m., for construction of state rural highway No. 25. Approximate quantities are 35,420 cu. yds. of grading, 16,230 lin. ft. of turn piking, 11,560 cu. yds. of graveling, 37 concrete culverts and two concrete bridges. Length of highway, 11 miles. Estimated cost, $26,606.20. Certified check 10 per cent. of bid. Theodore Peterson, county auditior.

CONTRACTS AWARDED.

Burlington, Wash.—To Cascade Construction Co., Seattle, for paving Garl street at bid of $10,373.84 and of Oak street at bid of $5,992.82.

Columbia City, Ind.—To H. P. Holman of Rochester, for paving Jackson and Walnut streets. Contract price, $39,108.

Olympia, Wash.—To J. H. Peterson, St. Johns, Ore., for construction of Pacific highway, at bid of $12,687.76. To Quigg Construction Co. of Wenatchee, Wash., for construction of Waterfront road at bid of $51,732.

Ottawa, Ill.—The $280,000 contract for the paving of West Ottawa was transferred from the James A. Sackley Co. of Chicago to John Cherry of Jacksonville, Ill.

Peoria, Ill.—To McElwee & Bushnell of Peoria, for paving alley between Elizabeth, Ellis, Main and Chambers streets, at bid of $1,459.80, and Glendale avenue from Jackson to Spring, at bid of $21,403.25.

Port Angeles, Wash.—To Lewis, Wiley & Morse, Seattle, at $194,600, for grading, filling, curbs, trestle work and walks on Railroad, Oakes and Laurel streets.

Richmond, Cal.—To Shattuck, Eddinger & Co., at $250,000, for construction of municipal tunnel and roadway to harbor front.

St. Marys City, Md.—To the Wm. P. McDonald Construction Co., Mount Vernon, N. Y., for paving 5.8 miles of road between this city and Leonardstown. Bid, $37,361.

Tampa, Fla.—To Edwards Construction Co. of this city, for thirty miles of paving in Pasco county, at $118,555.

Venice, Cal.—To Braun, Bryant & Austin of Santa Monica, at $50,149, for improvement of Compton-Santa Monica road from St. Marks boulevard to city limits.

CONTEMPLATED WORK.

Anderson, Ind.—The paving of various streets in Park Place is being urged by property owners. Mr. Funk, city engineer.

Bradentown, Fla.—Manatee county commissioners have called an election for March 26, to vote on $335,300 bonds to construct hard surfaced roads.

Coquille, Ore.—Construction of 30-ft. road, with 16-ft. hard surfaced concrete roadbed, at cost of $30,000, has been authorized by Coos county court.

Galesburg, Ill.—Ordinance is being considered by council for new pavements at an approximate cost of $90,000. F. M. Connelly, city engineer.

Milwaukee, Wis.—The paving of seven streets and alleys has been recommended by council committee on streets. Estimated cost $46,500. J. A. Mesiroff, city engineer.

Rock Island, Ill.—Board of local improvements has planned to pave 13th street with asphalt from First avenue to Seventh avenue. Wallace Treichler, city engineer.

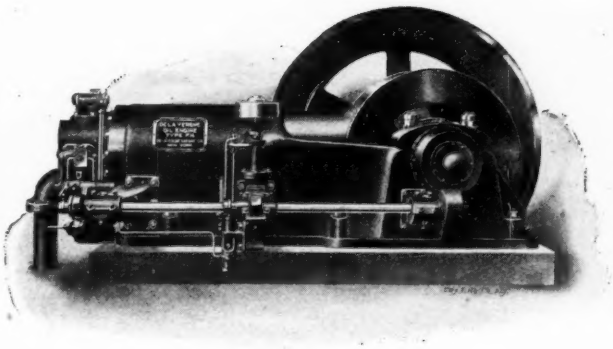
Sheboygan, Wis.—This city contemplates 75,000 sq. yds. concrete paving the coming season. Bids will be called for at various times in the year. C. U. Boley, city engineer.

St. Johns, Ore.—The paving of Willamette boulevard from Burlington street to St. Johns avenue at a cost of $19,000, and of Hatman avenue from Oswego to Central avenue, at a cost of $7,478, has been authorized by the city council. C. E. Andrew, city engineer.

Tacoma, Wash.—Pierce county commissioners have prepared plans for 17.18 miles of paved roads, including mountain-canyon road, 6.34 miles; the Puyallup-Orting road, 5.28 miles; the road from Sumner to the county poor farm, 1.56 miles, and the Pacific highway, Union avenue to Country Club, 4 miles.

Taylorville, Ill.—City will shortly ask bids on construction of approximately $100,000 worth of street paving, including 41,622 sq.

De La Vergne Oil Engines



are the most economical form of power known. The cost per horsepower hour is only a small fraction of a cent.

They run on the cheapest and heaviest grades of crude oil and also on waste residual tars which cannot be economically used in any other known way.

There is no handling of coal, ashes or any standby losses.

Over 30,000 are in Successful Operation

They are the ideal source of power for Municipal Lighting and Pumping Plants, Many are in use for this purpose

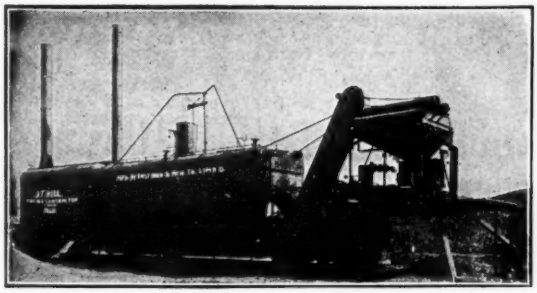
Send for Bulletin No. 132.

De La Vergne Machine Company

1161 E. 138th Street NEW YORK CITY

"MERRIMAN" ONE-CAR ASPHALT PLANT.

The Only Portable Plant That Melts Asphalt with Steam



No coking or burning of the asphalt as with direct heat.

Capacity, 1,800 yards two-inch top, or 4,000 yards one-inch binder in ten hours.

Built to attain season's results, as evidenced by the fact that one plant in a season laid 162,000 yards and traveled 1,260 miles.

Large contractors who are using our plants with those of other makes are replacing all other plants with ours. Could there be any better evidence of their superiority?

Such facts should be given consideration by the intending purchaser, as the season's profits may depend on the plant you have.

IT WILL COST YOU NOTHING TO INVESTIGATE. WRITE US.

THE EAST IRON & MACHINE COMPANY

LIMA, OHIO.

yds. of brick and 4,362 sq. yds. of concrete pavement. J. W. Dappert, city engineer.

Wallace, Ida.—Advertisements for bids for paving of district No. 1 will be made in the near future. Bitulithic will probably be used. Mr. Merriam, city engineer.

SEWERS.

BIDS REQUESTED.

Bogota, N. J.—Feb. 9, until 8 p. m., for constructing 4.4 miles of vitrified sewers, from 8 to 24 inches in size, with Y branches, manholes and flush tanks. Wm. N. Smith, mayor; Harold P. Ross, boro clerk.

Fairport, N. Y.—Feb. 11, until 8 p. m., for constructing 6,000 ft. of sewer, ranging in size from 18 inches to 8 inches, with 2 siphons, manholes and accessories. R. L. Williams, village clerk.

Kelliher, Minn.—Until Feb. 9, for laying approximately 2,900 ft. of 8 inch sewer mains. T. Milton Fowble, engineer, 34 Union block, St. Paul.

Lamoni, Iowa—Until Feb. 10, for constructing 23,500 ft. of 8-inch sewer, average cut 5 to 14 ft., 7,700 ft. 10-inch pipe sewer, average cut 5 to 10 ft. with Imhoff tank. Cost about $20,000. Bruce & Standeven, Omaha, engineers. J. F. Jones, town clerk.

Ortonville, Minn.—Feb. 16, until 8 p. m., for construction of sewer system, including general sewer, district and joint district sewers and laterals. Certified check 15 per cent. of bid, made payable to H. L. Zwiener, city treasurer. E. Scheibe, city clerk.

Peotone, Ill.—Feb. 3, until 3 p. m., for construction of system of vitrified tile pipe sewers, with brick manholes and catch basins, a concrete bulkhead and concrete settling tank. Approximate quantities 1 concrete outfall bulkhead, 1 concrete settling tank, 1,336 lin. ft. of 36-inch sewer, 1,810 lin. ft. of 30-inch sewer, 3,140 lin. ft. of 24-inch sewer, 1,680 lin. ft. of 18-inch sewer, 1,220 lin. ft. of 15-inch sewer, 6,310 lin. ft. of 12-inch sewer, 15,720 lin. ft. of 10-inch sewer, 103 brick manholes, 200 brick catch basins. Certified check 10 per cent. of bid. Aug. E. Harken, president board of local improvements.

CONTRACTS AWARDED.

Asbury Park, N. J.—T. W. K. Finn & Co., of this city, for construction of sewer system. Contract price $9,893.

Buffalo, N. Y.—To Frontier Contracting Co., Ellicott Square, Buffalo, for construction of sewer in Long avenue, at $12,890.

Fernwood, Pa.—To Cantrell Construction Co., Real Estate Trust Bldg., for 2 miles of sanitary sewers. Contract price, $12,600.

Joliet, Ill.—To Joseph P. McGovern, of this city, for construction of Second ward sewer system, at bid of $22.222.64. Other bidders were: Robert Shannon, $24,955.90; Foley Construction Co., Evanston, $25,764.50; Wm. Moran & Co., $26,415.75.

CONTEMPLATED WORK.

Osage, Iowa—E. E. Harper, Grand avenue, Temple, Kansas City, Mo., is preparing plans for a sewer system, $75,000.

San Diego, Cal.—Plans have been revised by Fred Lockwood, city engineer, for construction of a sewer system in the Ocean Beach section. Estimated cost, $10,000.

Scranton, Pa.—City Engineer Wm. Schunk has completed plans for two relief sewers, one to cost $78,500, and the other $79,500.

SEWAGE DISPOSAL PLANTS.

BIDS REQUESTED.

Bogota, N. J.—Feb. 9, until 8 p. m., for construction of two disposal plants, including necessary piping, grading, etc. Certified check, $2,000. Wm. N. Smith, mayor; Harlan P. Ross, boro clerk.

Fairport, N. Y.—Feb. 11, until 8 p. m., for construction of sewage disposal plant, consisting of following: Screen chamber, settling tanks, sludge bed and accessories, and involves removal of about 900 yards of earth, placing of about 230 yards of concrete, together with cast iron and tile sewers and drains, etc. R. L. Williams, village clerk.

Kelliher, Minn.—Until Feb. 9, for construction of a disposal plant. T. Milton Fowble, engineer, 34 Union Block, St. Paul.

CONTEMPLATED WORK.

Gary, Ind.—City Engineer A. P. Melton recommends the installation of a sewage purification system.

Sedalia, Mo.—Plans and specifications are being prepared by Engineers Burns & McDonnell, Scarritt Bldg., Kansas City, Mo., for complete sewage disposal works for southwest Sedalia.

WATER WORKS.

CONTRACTS AWARDED.

Valliant, Okla.—To Davis & Baun, of Caddo, Okla., for construction of waterworks system, at $32,700.

Winchester, Ill.—To C. M. Hanes, Jerseyville, Ill., for construction of municipal waterworks system. Contract price, $23,075.00.

CONTEMPLATED WORK.

Bruning, Neb.—City will probably receive bids in from four to six weeks for installation of waterworks and an electric light plant. Grant & Fulton, Lincoln, Neb., engineers.

Cedar Rapids, Iowa—Bonds for $125,000 have been voted for a dam for water works system. Ira G. Hedrick, engineer, Kansas City, Mo.

Chelsea, Ia.—Plans and specifications are being prepared by Engineer E. E. Harper, Grand avenue, Temple, Kansas City, Mo., for waterworks system.

Coquille, Ore.—Improvements and extensions to water system here will be made shortly. Estimated cost $13,400. P. M. Hall, Lewis, city engineer.

Imperial, Cal.—Citizens have voted $29,000 bonds for installation of a waterworks system. I. B. Funk, city engineer.

Manhattan, Cal.—Bids will be opened in about 10 weeks on proposed waterworks system. Frank A. Lathrop, engineer.

Moline, Ill.—Bids upon the $109,000 water main for the East End will be advertised for by Board of Local Improvements at a date in near future. F. A. Dawson, city engineer.

Moorestown, N. J.—George Pfeiffer, engineer, Second and Market streets, Camden, N. J., is preparing plans and specifications for an addition to the waterworks.

Moulton, Iowa—Plans and specifications are being prepared by Engineer E. E. Harper, Grand avenue, Temple, Kansas City, Mo., for waterworks system.

New York Mills, Minn.—Village contemplates the installation of a waterworks system in the spring; estimates on probable cost are being secured.

Oneida, N. Y.—City Engineer J. M. Hutton is preparing plans for proposed extension of Sylvan Beach water system; estimated cost $15,000.

Perry, Iowa—$35,000 has been voted for the extension and improvement of the waterworks plant. Adrian Cross, city clerk.

Spotswood, N. J.—Mayor Arthur B. Appleby advocates installation of municipal waterworks system; estimated cost, $16,000.

Washington, N. C.—Plans have been prepared by Engineer Gilbert C. White, Char-

MIETZ & WEISS OIL ENGINES

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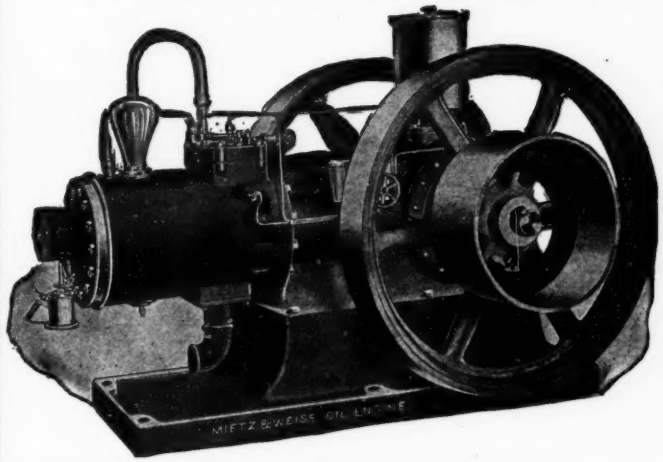

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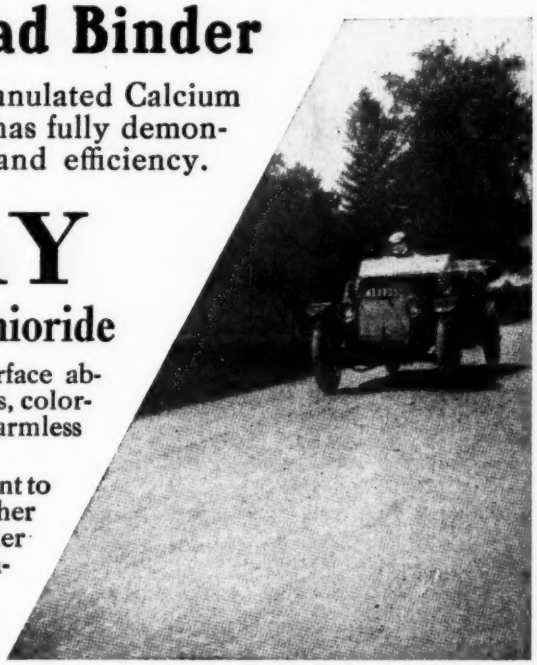

State Road, Geneva to Canandaigua, N. Y.

lotte, N. C., for waterworks and electric light plant, estimated to cost $100,000; work includes 1,000,000-gallon filter plant, 500,000-gallon storage reservoir, steam pumps, boiler plant, 500 k.w. electric light and power plant; bonds to be sold after which plans will be sent out and work advertised. H. B. Charles, superintendent.

BRIDGES.

BIDS REQUESTED.

Americus, Ga.—Feb. 15, until 9 a. m., for construction of two bridges of reinforced concrete for Sumter county. W. J. Watson & Co., engineers, Charlotte, N. C.

Beaver City, Neb.—Feb. 26, until noon, for construction of bridge across the Republican river, south of Cambridge, Neb. Bids will be received on alternate designs as follows: First, one concrete girder bridge composed of nine 32-foot 6-inch spans, 20-foot roadway with concrete piers and abutments. Second: One concrete arch bridge composed of two 50-foot arches, two 55-foot arches and one 60-foot arch, 20-foot roadway with concrete piers and abutments. Third: One steel bridge composed of two 135-foot high truss riveted spans, 20-foot roadway, with either concrete or wood block floors and concrete piers and abutments. Certified check, $1,000 made payable to J. P. Nickerson, county clerk, Furnas county.

Cleveland, O.—Feb. 21, until 11 a. m., for construction of bridge work per Report No. 3244, Culvert, Bliss Road Euclid township. Certified check, 10 per cent. of bid. Ed. G. Krause, clerk board of Cuyahoga county commissioners.

Gold Beach, Ore.—Until April 8, for construction of a reinforced arched plan concrete bridge across Chetco river. Bidders are to submit their own designs. For further information address J. M. McCoughell, surveyor, Curry county.

New Orleans, La.—Feb. 25, until 11 a. m., for the erection of a Strauss trunnion bascule bridge, over the entrance to the Southern Yacht Club pier on the line of the New Basin Canal Shell road. Certified check, $500. A. G. Rinks, commissioner department of public finance.

Waseca, Minn.—Feb. 5, until 2 p. m., for building two bridges, repairing one bridge and two reinforced concrete culverts. Certified check, $100. Theodore Peterson, county auditor.

CONTRACTS AWARDED.

Aberdeen, S. D.—To Minneapolis Steel Machinery Co., for six county bridges to be built in spring. Bid $11,215.00.

Danville, Ill.—To East St. Louis Bridge Co., East St. Louis, at $7,540 for construction of 150-foot steel bridge over Middle Fork of Vermillion river at Johnson ford.

Des Moines, Iowa—To Iowa Bridge Co. for construction of bridge over Raccoon river near Valley Junction. Contract price $3,225.

Geneva, Neb.—To Standard Bridge Co., Omaha, Neb., for construction of bridges in Fillmore county during 1914.

Joplin, Mo.—To O'Hagan & Lake, of Kansas City, for construction of Broadway viaduct at bid of $96,133.00.

Mandeville, La.—To Ernest Faure, for rebuilding three bridges across Bayou Castaign.

Racine, Wis.—To Worden-Allen, Milwaukee, for bridge work in connection with Dover Drainage canal, at $9,500.

York, Neb.—To Western Bridge & Const. Co., of Omaha for construction of all steel and wooden bridges in York county in 1914.

CONTEMPLATED WORK.

Chattanooga, Tenn.—Hamilton county has voted a bond issue of $500,000.00 for erection of bridge across river at Chattanooga, Tenn. Bridge engineers are invited to submit competitive designs and estimates by Feb. 18. For further information address Theo. F. King, chairman; L. B. Bryan, secretary, of Tennessee River Bridge committee.

Chicago, Ill.—Construction of a viaduct double-decking Franklin street from Kinzie to South Water street over Chicago river is being considered by council. L. E. McGann, commissioner of public works.

LaCrosse, Wis.—Board of public works has been instructed to call for new bids for constructing a steel or reinforced concrete bridge at St. Andrew street. E. E. Hoffman, city clerk.

Muncie, Ind.—Board of county commissioners of Delaware county will receive bids in spring for the repair and extension of following bridges: High street, estimated cost, $8,500; Washington and Elm streets bridges, cost, $7,000, and West Jackson street, $6,500. S. H. Weber, county surveyor; F. M. Williams, auditor.

St. Paul, Minn.—A new $1,000,000 bridge to extend from Seven corners directly to the southern end of the present High bridge has been proposed. Oscar Claussen, city engineer.

AUTOMOBILES.

FIRE APPARATUS.

Auburn, N. Y.—Chief E. J. Jewhurst, recommends the purchase of another piece of motor apparatus.

Bridgeport, Conn.—Town chief's cars may be purchased; also three tractors for hook and ladder trucks. Edward Mooney, fire chief, 175 Williams street.

Cincinnati, O.—Fire Chief Bunker has recommended the motorizing of the ladder equipment and improvement of alarm service. He also asks for one additional auto pumping engine, one auto combination wagon, one extra marshal's auto, two small automobiles, for the fire alarm and hydrant service and one auto fuel truck. Total cost $122,250.

Great Falls, Mont.—Feb. 2, until 8 p. m., for one combination motor-driven police patrol and ambulance for police department. Certified check 2 per cent. W. H. Harrison, city clerk.

Ithaca, N. Y.—Chief John A. Fisher recommends purchase of two pieces of motor apparatus, including a city service truck, and 3,500 feet of hose.

Springzeld, O.—City Manager Charles A. Ashburner plans to motorize the street cleaning department.

Toledo, O.—The purchase of a motor patrol wagon and ambulance at cost of $5,000 and of an eight passenger touring car to cost $5,000 is being considered by the safety department. Mr. Kapp, safety director.

Westboro, Mass.—Board of fire engineers recommends the purchase of an automobile combination chemical wagon. Thos. H. Treadway, chief engineer.

GARBAGE DISPOSAL.

BIDS REQUESTED.

Highland Park, Mich.—Until February 16, for the installation and completion of a garbage incinerator plant; capacity one ton per hour designed to accommodate a future plant with a capacity of two tons per hour. L. D. Beckley, superintendent of public works.

Lockport, N. Y.—Feb. 16, until 8 p. m., for construction of an incinerator plant, buildings consisting of two 10-ton units with capacity of reducing 20 tons of garbage per day of 24 hours, also for furnishing and erecting a complete garbage reduction and refuse incinerator plant and buildings of

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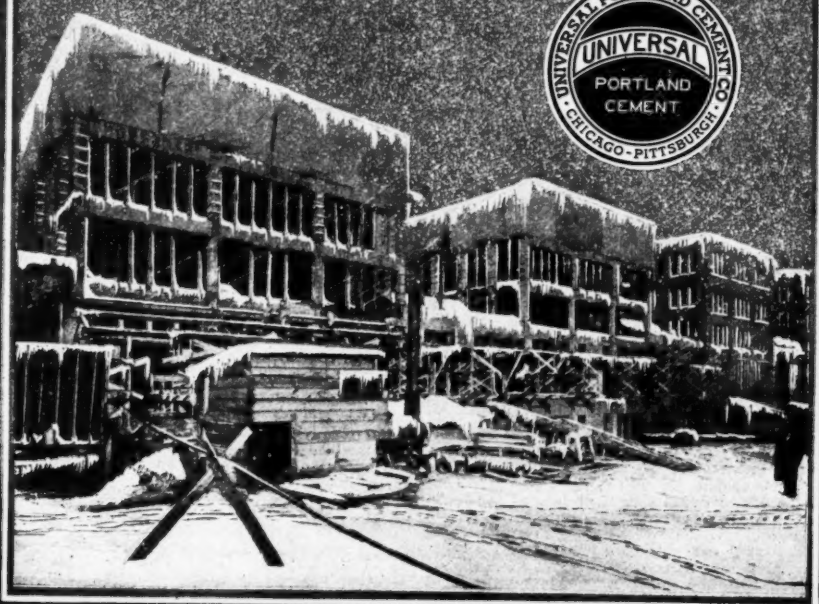

same capacity as incinerator plant. Certified check, $2,000. Peter S. Hall, superintendent department of public safety.

LIGHTING.

Bowling Green, Ky.—City council plans to enlarge and improve municipal electric light plant to provide additional current for an ornamental street lighting system. James H. Wilkerson, superintendent.

Clayton, Ala.—Bonds for $5,000 have been voted to be used in improving the municipal electric light plant. M. D. Morton, superintendent.

DeGraff, Minn.—An election will soon be held to vote on question of bond issue for construction of municipal electric light plant.

Fordville, N. D.—The village of Fordville is contemplating installation of combined electric light plant and fire protection system and invites correspondence with parties and firms doing this sort of work. Address Secretary Commercial Club, Fordville, N. D.

BUILDINGS.

BIDS REQUESTED.

Cincinnati, O.—Feb. 17, until noon, for erection of hospital building. Work will embrace the following departments: 1. General conditions. 2. Excavation and concrete foundations. 3. Brickwork. 4. Carpenter work. 5. Iron and steel work. 6. Tin, galvanized iron and steel work. 7. Plastering and "Stonekote." 8. Terrazzo floors. 9. Painting and glazing. 10. Plumbing and gas fitting. 11. Electric wiring. 12. Hot water heating system. 13. Lighting fixtures. . 14. Vacuum cleaning system. 15. Dumb waiter. 16. Refrigerators. 17. Kitchen equipment. 18. Sterilizing equipment. 19. Incinerators. 20. Fly screens. 21. Telephones. 22. Clock. 23. Elevator. Certified check, 10 per cent. of bid. Frederick S. Spiegel, president board of hospital commissioners.

Grand Rapids, Mich.—Feb. 16, until noon, for general construction, plumbing, heating, ventilating and wiring of the South High School. Certified check, 2 per cent. of bid, payable to president of board of education. H. N. Morrill, business manager, board of education.

Granada, Minn.—Feb. 3, until 10 a. m., for erection of school building, also installation of heating, plumbing and ventilating. Certified check, 3 per cent. of bid. Kirby T. Snyder, architect, Suite 751 Plymouth Bldg., Minneapolis, Minn.; C. C. Chamberlain, clerk board of education, District No. 30, Martin county.

Kingsville, Tex.—March 1, until noon, for erection and completion of a fireproof court house and hospital. Certified check, $3,000, made payable to Ben F. Wilson, county judge. Atlee B. Ayres, architect, Bedell building, San Antonio, Tex.

Lyons, Iowa—Feb. 10, until 8 p. m., for constructing a brick and stone fire station. Certified check 5 per cent. of bid. John H. Ladehoff, architect. Clinton, Iowa; Frank W. Leedham, city auditor.

New Orleans, La.—Feb. 26, until noon, for construction of a one-story brick building. The principal items of contract are as follows: Excavation, 20,000 cubic yards; round piling, 56,000 lineal feet; sheet piling and bracing, 240,000 feet B. M.; concrete, 3,000 cubic yards; structural steel, 52 tons; steel rods, 300,000 pounds. Certified check, $2,500. Geo. G. Earl, general superintendent; F. S. Shields, secretary, of sewage and water board, room 508, City Hall Annex.

Riceville, Iowa—Feb. 12, until 1 p. m., for erection of an addition to the Riceville school. A. G. Dunton, secretary of school board.

PARKS.

Indianapolis, Ind.—The Indianapolis Park Board will expend $74,782 in the east park district during 1914. Dr. Henry Jameson, president of board.

MISCELLANEOUS.

BIDS REQUESTED.

Baudette, Minn.—Feb. 12, until 8 p. m., for the following work, erecting complete ready for operation, one boiler, one engine and direct-connected alternating generator with belted exciter, switchboard panel, boiler feed pump, steel smoke stack with brick stack base and horizontal smoke connection to connect with boiler now in plant with all proper connections and accessories delivered and erected in engine and boiler room of the water and light plant. Certified check, 10 per cent. of bid. Franz W. Schmidt, acting clerk.

El Paso, Tex.—Feb. 12, until 3 p. m., for waterworks machinery as follows: One steam driven air compressor, 4,000 to 5,000 cubic feet per minute capacity; one steam driven, crank and fly-wheel, outside center packed plunger pump, capacity 4,000,000 to 5,000,000 gallons in 24 hours; two water tube boilers, 180 to 200 horse power each; one surface condenser, capacity 15,000 pounds of steam per hour. Two or more internal combustion engines of sufficient power to drive the compressors and pumps mentioned below; one or more air compressors of from 3,000 to 4,000 cubic feet total capacity; one or more power pumps of 3,000,000 to 4,000,000 gallons capacity or in lieu of the power pump; one or more centrifugal pumps of the same capacity as the power pumps. Certified check, 10 per cent. of bid. C. W. Fassett, city clerk.

Fergus Falls, Minn.—March 24, until 2 p. m., for furnishing certain road tools and machinery. Certified check, $100, payable to treasurer of Otter Tail county. For further information address Wm. Lincoln, county auditor, Fergus Falls.

Helena, Mont.—March 2, until 8 p. m., for two 600-gallon tank street sprinklers, f. o. b. Helena. Certified check, 10 per cent. of bid. D. J. McConnell, city clerk.

Indianapolis, Ind.—Feb. 19, until 10 a. m., for one steam roller. W. T. Patten, auditor Marion county.

Indianapolis, Ind.—Until Feb. 4, for 500 tons of asphalt to be delivered during 1914. B. T. J. Jeup, city engineer.

Kansas City, Mo.—Feb. 16, until 2 p. m., for exclusive contract for operating a cafe and vending stands at the refectory and refreshment booths in Swope Park for season of 1914-1915. Certified check, $200. T. C. Harrington, secretary board of park commissioners.

Manhattan, Kans.—Feb. 17, until noon, for construction of certain open ditches and an earth levee. Bids are solicited for the work in sections and for construction of all work. Total estimated amount of excavation and embankment, 136,000 cubic yards. Certified check, 6 per cent. of bid. Date of completion December 1, 1914. H. B. Walker, drainage engineer, State Agricultural College, Manhattan, Kans., is supervising engineer of the district.

CONTEMPLATED WORK.

Indianapolis, Ind.—The construction of a retaining wall along south bank of Fall Creek, from College avenue to Thirtieth street, is being considered by park commissioners and board of public works. Estimated cost, $80,000. Dr. Henry Jameson, president board of park commissioners.